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Insulation in the Glass Plant

By J. D. VanValkenburgh[1]

THE mille fiore glass of Venice was produced as a result of millenniums of world experience in the working of glass, and the tools of manufacture were much the same as would be used for this class of work in modern times. The melting, reheating and annealing operations, however, were conducted with furnace equipment pitifully antiquated according to twentieth century standards. It is true that the technique of glass blowing in the fifteenth century covered more working variables for one variety of product than are included in the entire scope of the field at present.

Many of these variables have been eliminated, and convenience, economy, speed and reliability substituted by introduction of scientific principles in mixing and working. The use of machinery and specialized methods have accomplished a great deal in certain branches of commercial work, and the industry at large is benefited by notable improvements in furnace materials and design which have been gradually developed during the last fifty years.

Not least among these advances lie the economies and advantages in furnace operation which result from the proper use of suitable insulation. In this writing it is proposed to discuss the advantages which attend this modern practice, and point out some specific applications of particular importance.

Surface Temperatures

The natural inclination of the plant operator is to lay his hand upon a furnace casing and exclaim, "This is a wasteful furnace; I cannot hold my hand upon the casing," or, "This casing is barely warm; the furnace must be well designed."

Such conclusions, even admitting the use of physiological test methods, are subject to errors of several hundred per cent. If we were to say that surface temperature gives no indication of the heat loss, we would be overstating the facts. However, such a remark smacks more of the truth than the statement that surface temperature determines heat loss. Not infrequently, a low surface temperature is attended by high heat loss, and vice versa.

To illustrate, air circulation increases the rate of heat transfer from a surface. This tends to cool the surface and to increase the total rate of heat transfer through the construction in question. Therefore, *with lower surface temperature more heat is being transmitted.* Another example is the case of parallel walls on opposite sides of an alleyway. Here radiation of heat from one wall to the other tends to increase greatly the surface temperatures. As a result, the temperature gradient in each wall, and consequently the rate of heat transfer, is decreased somewhat and the resulting situation is that *with a higher surface temperature less heat is being transmitted.* Other conditions which materially affect surface temperatures are the temperature of the surrounding air, the degree of exposure to other hot or cold surfaces, the nature of the surface and air leakage through the wall. While these variables will have little effect on the total heat transmitted through a thoroughly insulated wall where most of the resistance to heat flow is inherent in the insulation itself, they may have an entirely disproportionate effect on surface temperatures.

If the conditions be limited by defining the outside of the furnace as impervious to gas passage, subject to a definite temperature difference from room air and reradiating surfaces, and passed over by air at a certain velocity, then some idea of the magnitude of heat loss may be gained by reference to the chart in Fig. 1, which has been drawn for surface temperatures commonly observed on uninsulated furnaces.

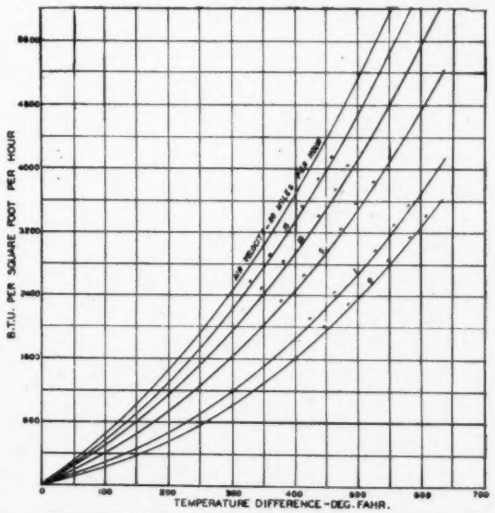

FIG. 1. HEAT LOSSES FROM UNINSULATED HOT SURFACES

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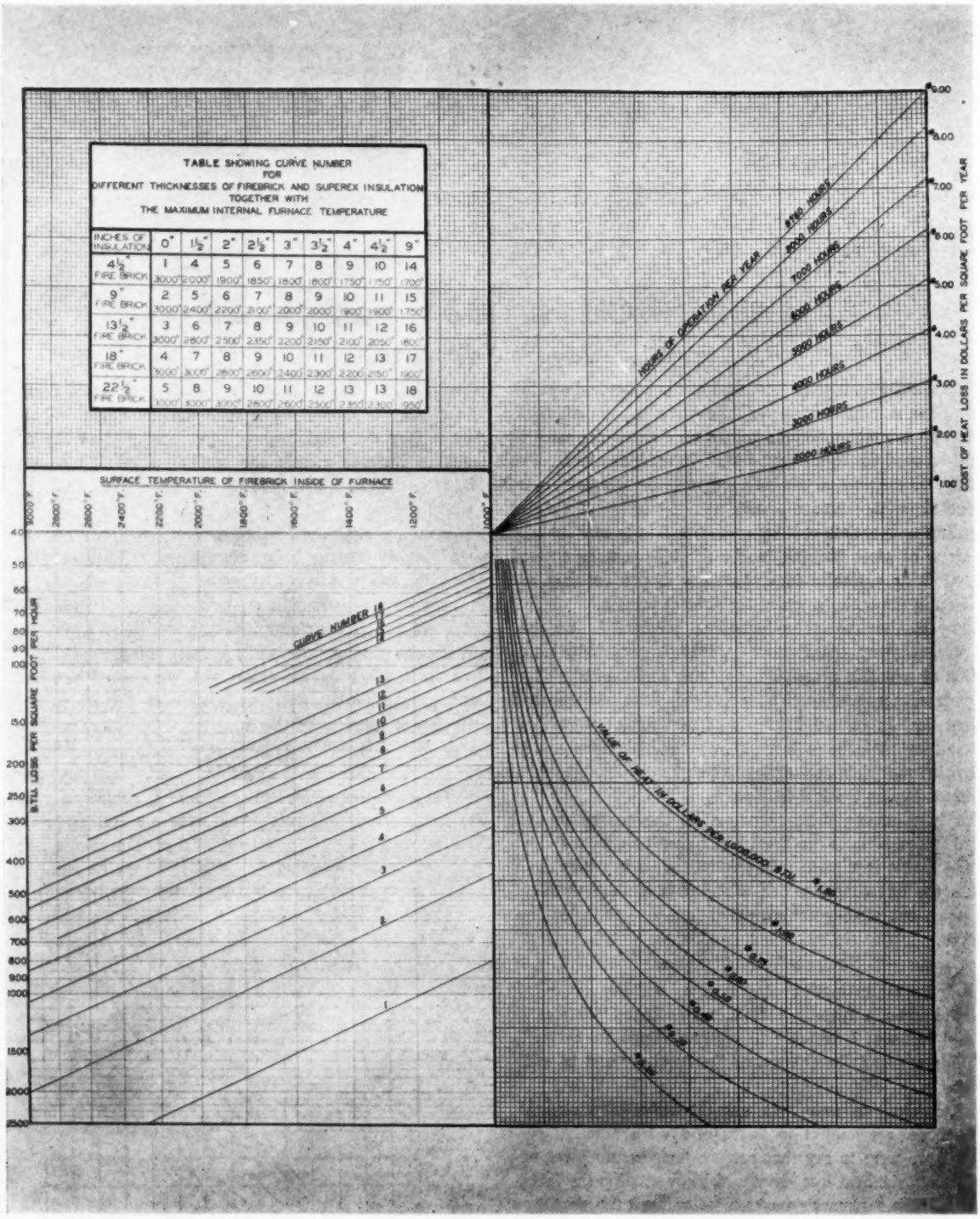


TABLE SHOWING CURVE NUMBER
FOR
DIFFERENT THICKNESSES OF FIREBRICK AND SUPEREX INSULATION
TOGETHER WITH
THE MAXIMUM INTERNAL FURNACE TEMPERATURE
INCHES OF INSULATION
0" 1½" 2" 2½" 3" 3½" 4" 4½" 9"
4½" FIRE BRICK
1 4 5 6 7 8 9 10 14
3000° 2000° 1900° 1850° 1800° 1800° 1750° 1750° 1700°
9" FIRE BRICK
2 5 6 7 8 9 10 11 15
3000° 2400° 2200° 2100° 2000° 2000° 1900° 1900° 1750°
13½" FIRE BRICK
3 6 7 8 9 10 11 12 16
3000° 2800° 2500° 2350° 2200° 2150° 2100° 2050° 1800°
18" FIRE BRICK
4 7 8 9 10 11 12 13 17
3000° 3000° 2800° 2600° 2400° 2300° 2200° 2150° 1900°
22½" FIRE BRICK
5 8 9 10 11 12 13 13 18
3000° 3000° 3000° 2850° 2600° 2500° 2350° 2300° 1950°
SURFACE TEMPERATURE OF FIREBRICK INSIDE OF FURNACE
3000° F. 2800° F. 2600° F. 2400° F. 2200° F. 2000° F. 1800° F. 1600° F. 1400° F. 1200° F. 1000° F.
B.T.U. LOSS PER SQUARE FOOT PER HOUR
CURVE NUMBER
HOURS OF OPERATION PER YEAR
8760 HOURS
8000 HOURS
7000 HOURS
6000 HOURS
5000 HOURS
4000 HOURS
3000 HOURS
2000 HOURS
COST OF HEAT LOSS IN DOLLARS PER SQUARE FOOT PER YEAR
$9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
VALUE OF HEAT IN DOLLARS PER MILLION B.T.U.

FIG. 2. CHART SHOWING HEAT LOSSES AND THEIR COST FOR VARIOUS OPERATING CONDITIONS
The use of this chart assumes solid firebrick walls and still room air at 75° F., and neglects side flow of heat and conduction through steel work.

Heat Savings by Means of Insulation

One very common conception places insulation with respect to heat in the same capacity as a raincoat with respect to rain. This idea emphasizes the importance of having a layer of heat-stopping material in the path of waste heat flow, but fails to show heat conservation with different thicknesses of insulation in its true light as a purely relative matter. In order to stop the heat as a good raincoat stops the rain, it would either be necessary for insulation to be infinitely thick, or it would be necessary to have a thermal

conductivity of zero, which is beyond comprehension.

It is the best practice to properly apply suitable insulation to the thickness necessary for conservation of that portion of waste heat which may be economically saved, and allow the final increments to be dissipated to the room, since the expense of saving them is not justified.

The effect of insulation of various thicknesses in reducing heat losses for given conditions of furnace operation may be illustrated by reference to Fig. 2 which has been prepared for a certain specific insulating material.

The heat loss chart is only approximately accurate because of the grouping of different wall constructions into various single curves, but the values obtained in the manner outlined below will be in agreement with computed results within $\pm 5\%$.

From the table in the upper left hand corner select the number corresponding to the furnace construction which it is desired to investigate. Then from the curve bearing this number in the lower left hand corner of Fig. 2, read the computed hourly B. t. u. loss for any desired furnace temperature.

For example, a bare wall of 13½" firebrick with an interior furnace temperature of 2200° F. shows a computed hourly loss of about 880 B. t. u. per square foot. Insulated with 2" of Superex blocks this loss is reduced to about 425 B. t. u., and with 3" of Superex is still further reduced to about 340 B. t. u.

The computed value of waste heat saving may be determined from the right hand charts of Fig. 2. By projecting to the right from the B. t. u. loss per square foot per hour to the curve showing evaluated worth of heat per million B. t. u. actually available inside the furnace, then projecting vertically to the hours operation per year and reading the scale of dollars, the cost of heat lost per square foot per year is obtainable directly. Then through subtraction, the difference in cost of waste heat per square foot may be determined for various constructions. By this means the saving incidental to the use of 2" of Superex in the above example is found to be $1.00 per square foot per year, if we assume continuous operation and heat worth $.25 per million B. t u. Correspondingly, the 3" of Superex would save $1.20. In other words, the yearly saving brought about by the additional inch of insulation amounts in this case to $.20 per square foot.

Scope of Furnace Insulation Application

Then it is perfectly obvious that a relatively thin application of suitable material is highly effective in reducing heat loss, thereby cutting down the expense of furnace operation. But where should insulation be applied, and how does one know the proper thickness?

The answers may be stated in a series of rules, which are so self-evident in themselves as to be axiomatic in character.

1. Suitable insulation should be applied to every surface where the net result of this application is beneficial or advantageous.

2. Where furnace temperatures are high, insulation must not be provided of a thickness so great as to raise the mean temperatures of the refractories beyond the limit of safety.

3. Insulation should not be applied to any extent great enough that the insulation itself will be appreciably disintegrated by the temperatures impressed upon its inner surface.

4. Subject to the above limitations, insulation should be used in such thickness that the evaluated yearly benefits, accruing from its final increment of thickness, pay the required return on the investment occasioned by the installation of the final increment.

The more refractory insulating materials, or those manufactured to withstand higher temperatures, are ordinarily stronger and denser but poorer in insulating quality and more expensive than those manufactured for lower temperature operation. Combinations of insulating materials in double layer work, therefore, frequently make for economy in first cost and higher operating efficiency.

It is evident that the adaptation of an insulating material to a specific usage is dependent upon its physical properties. The transmission of compressive stress through the block is allowable subject to the limitations of the material itself. The practical conception of insulation should be that of a material manufactured to retard heat flow, introduced into and supported as an integral part of the furnace construction. By way of amplification it might be pointed out that the use of suitable insulation behind buckstaves and furnace casing is well justified structurally, but to carry arch thrust at the skewbacks or to serve as base support under heavy brick walls, the structural demands are beyond the range of the more efficient insulating materials.

The curves of Fig. 2 are so prepared that any combination of firebrick and insulation thicknesses which appears in the table is safe for use, up to the furnace temperature indicated, in as far as safety is dependent upon the allowable temperature range of Superex insulation and ordinary firebrick. The proper thickness of insulation is determined by the conditions of operation of the particular furnace under consideration.

The benefits of insulation used in the construction as planned must be reduced to some arithmetical value per square foot of insulated surface, if a definite thickness is to be decided upon by calculation. Some of these advantages, as will be brought out by discussion in the following paragraphs, are not easily reduced to dollars per square foot per year. The element of judgment, therefore, is bound to enter into any final recommendation. The decision may be assisted, however, by calculating the economical thickness from saving in heat loss, which is readily evaluated on a square foot basis.

If the erected cost of insulation per square foot per inch of thickness is taken at $.20, and a gross yearly return of 25% is required to cover charges, pay a sufficient profit to justify the expenditure, and amortize the initial cost in the desired period, then the last inch of insulation thickness must save about $.05 per square foot per year to fulfill the conditions. The thickness of insulation first applied then makes a higher return than required each year of its life, and the final inch pays just the profit that is necessary to justify the investment.

One way of approximating this economical thickness lies in following through the charts of Fig. 2, for given furnace conditions and additional 1" thicknesses of insulation. When the difference in cost of waste heat lost for successive inches of insulation over the firebrick equals the fixed charges of the inch of insulation erected in place, (in the above example $.05), then the approximate economical thickness of insulation has been reached. A method of arriving at this result analytically will be discussed later.

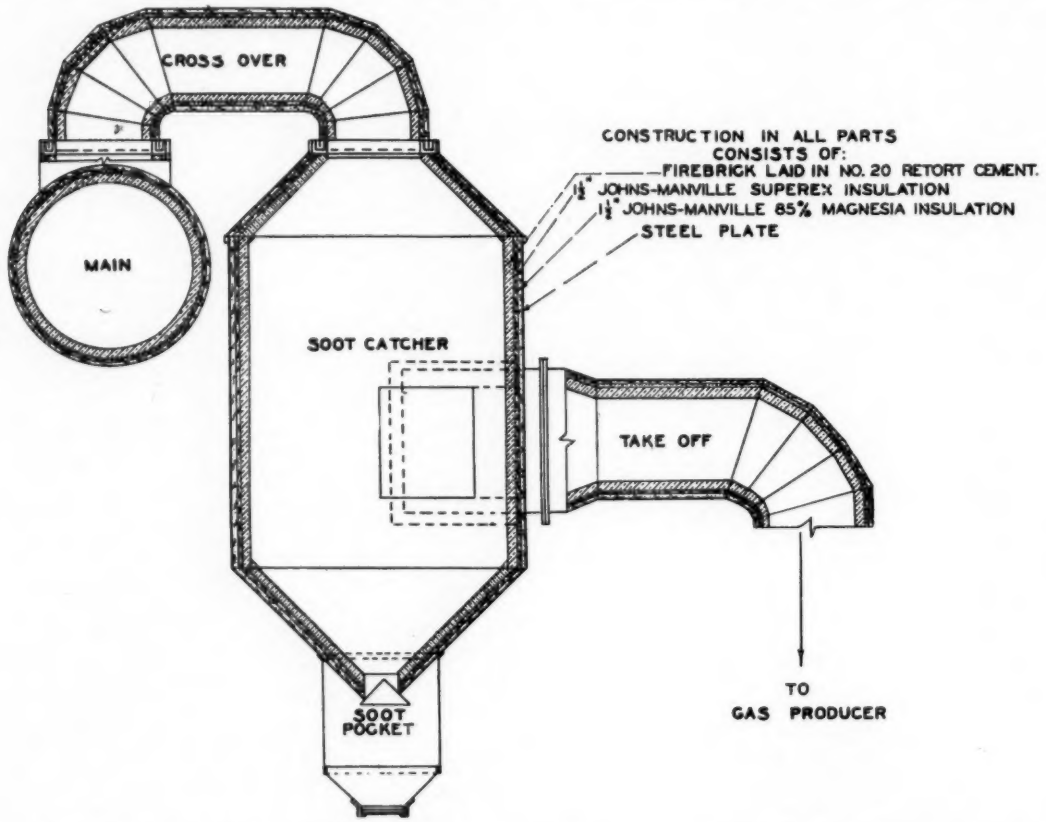


FIG. 3—SECTIONAL ELEVATION SHOWING INSULATION APPLIED TO PRODUCER GAS MAIN AND ACCESSORIES

Other Effects of Insulation

We have noted the marked reduction in heat losses through the proper use of suitable insulation, and the corresponding reduction in expense of furnace operation. The amount of heat saved, when shown as a percentage of the gross heat in fuel, may be small, but it should be noted that a low percentage of an item involving large expenditures often appears as a generous sum when expressed in dollars per year. Another point, which deserves emphasis, deals with the fact that heat saved by insulation corresponds to an equivalent range of temperature in the upper reaches of the scale, and the value of furnace heat per million B. t. u. delivered at higher temperatures is much greater than the corresponding value at lower temperatures. These primary effects are far reaching and result in several advantages worthy of closer observation under the heading of particular furnaces.

Attention has been called to the fact that insulation should be thin enough not to build up undue temperatures on the refractories. This statement is true, but is incomplete unless we observe that the effect of insulation properly used is to ease the load on refractories. By decreasing the slope of the temperature gradient through the firebrick in a furnace wall, and by causing side flow of heat from warmer to cooler portions of the wall, insulation makes for a more uniform temperature throughout the brickwork, reduces spalling, and tends to prevent cracking and shifting from unequal expansion. This also results in more uniform furnace heat, betters the product, and makes possible the maintenance of a lower maximum furnace temperature which saves fuel and further protects the brickwork.

Glass plant operators usually consider air infiltration a greater source of loss than radiation. There may be some argument as to which is the greater source of waste, but it is certainly true that air leakage through settings results in much aggravated complaint. This brings up a fortunate corollary effect of properly applied block insulation of suitable physical characteristics. By breaking the joints in double layer work, closely butting the blocks, pointing up with good asbestos cement, and securely fastening the insulation in place, a leaky wall may be sealed against air infiltration or gas extrusion. The consideration of specific applications will assist in showing the interrelation of the above factors.

Insulation of Gas Producers and Producer Mains

The general use of producer gas in glass manufacture lends interest to the application of insulation to the equipment used in generating and conveying this fuel. However, it is impossible to generalize about the insulation of the gas producers themselves because of variations in design. It is ordinarily advantageous to insulate the upper portions with high temperature blocks to a thickness of 2" or more, depending on conditions. The details of application are worked out differently for each kind of producer.

For the gas take-offs, soot catchers, cross-overs and mains, standard specifications have been developed which have been in successful use for a number of years, with only minor variation of thickness from job to job, depending on the importance of conserving the sensible heat of the gas. Practically all other equipment in the glass plant can be insulated in an existing state, but the gas mains and accessories have to be insulated while they are being lined or re-lined, for the reason that insulation is installed between the firebrick lining and the steel shell.

One of the best specifications provides for two 1½" thick layers of suitable block insulation, applied broken joint method on the inside of the shell, all joints being tightly butted and pointed up with asbestos cement. Various alternate methods are available for evening up the inside surface of the blocks to compensate for the inequalities of "shingle lap" or "in and out lap" in the construction of the steel shell. The firebrick lining is set up over the insulation on the inside of the main.

The use of a good plastic refractory cement is important in bonding the firebrick, in order to keep tar and other condensible matter from impregnating the insulation and lowering its efficiency. Because the gas is hotter in an insulated main there is a marked reduction in deposition of tarry vapors, but burnouts are still necessary, though at less frequent intervals.

Besides increasing the length of time between burnouts, the reduced tar condensation in an insulated main is responsible for delivering higher calorific gas at the furnaces. If the vapors are maintained in suspension by the high temperature of the gas and the hotter lining, the result is a higher heat value of the gas. The minimizing of tar deposition also has a highly beneficial effect on the operation of regenerator reversal valves.

Of course, the primary function of insulation in a producer main lies in saving the sensible heat of the gas. In the case of cold producer gas, which contains none of the heat of generation, it is possible to develop on burning the gas about 70% of the heat originally in the coal from which the gas was made. By conserving the heat of generation in a well insulated main, it is possible to develop as much as 93% of the heat in the coal.

With 1400° F. gas in the main, heat loss per square foot per hour through 4½" firebrick lining amounts to 1250 B. t. u. Insulated according to the above noted specification this loss is reduced to 239 B. t. u. On the basis of heat worth $.25 per million B. t. u. and continuous operation, the reduction in wasted heat by the proper use of insulation amounts to $2.20 per square foot per year. The cost of insulating materials necessary to effect this saving is less than $.50 per square foot. It is evident then that the insulation will pay for itself every few months, and will continue to do so throughout the life of the lining.

If a suitable block insulation is properly installed in the producer main lining, the length of time between lining renewals is not shortened. In fact, the tendency seems to point toward longer life of refractories in insulated mains. Many insulated jobs are going in lately with 2½" of firebrick over the blocks. This is a relatively new trend, but it seems to be meeting with success. The fact that firebrick thickness can be reduced when insulation is properly used indicates one more economy due to lessened load on refractories.

Tank and Pot Furnaces, Recuperators, Regenerators and Uptakes

At the time of this writing the subject of insulation as applied to walls and crowns of tank and pot furnaces is so controversially confused that contradictory reports, information and opinions preclude brief generalizations. The matter is well worth a protracted study in representative plants, which could serve as the basis of a report clarifying the issues involved. For present purposes it seems sufficient to say that walls and crowns are sometimes insulated, depending on the design and construction of individual furnaces. A special investigation of the particular refractory conditions under consideration is now the only method by which insulation recommendations may be evolved. An interesting discussion of this subject by W. K. Brownlee was made before a members' meeting of the Glass Container Association in Washington, D. C., on February 3, 1928. This paper[2] is available in bulletin form at the headquarters of the Association, 19 West 44th Street, New York.

In the case of regenerators and recuperators as used with the above furnaces, there is no question as to the efficacy of insulation or its universal adaptability. The application of insulation to recuperators and regenerators is so similar that only regenerators will be discussed here.

One generally recommended specification for regenerator walls provides 3" of suitable block insulation applied in two layers with broken joint construction, all blocks being closely butted, pointed up with asbestos cement and properly hard finished over the exterior surface or cased with the more durable asbestos wood. All steel work is left sufficiently exposed to prevent its reaching undue temperatures. The crowns of the checker chambers are insulatd with 2" blocks, similar to the side walls, but applied in one layer and finished with ½" asbestos cement. The base of a new checker chamber is insulated with 2" of blocks underneath the firebrick.

Protection due refractories in flues and uptake walls limits the thickness of insulation which may be applied to this section. According to the specification above mentioned one layer of 2" blocks is provided over the uptakes in a manner constructionally similar to the side walls of the regenerators.

The insulation of these chambers and passages through which flue gas and fuel gas or air are forced in alternation has been the subject of so much discussion in recent years,

[2] Published originally in THE GLASS INDUSTRY, March, 1928, pp. 60-62.

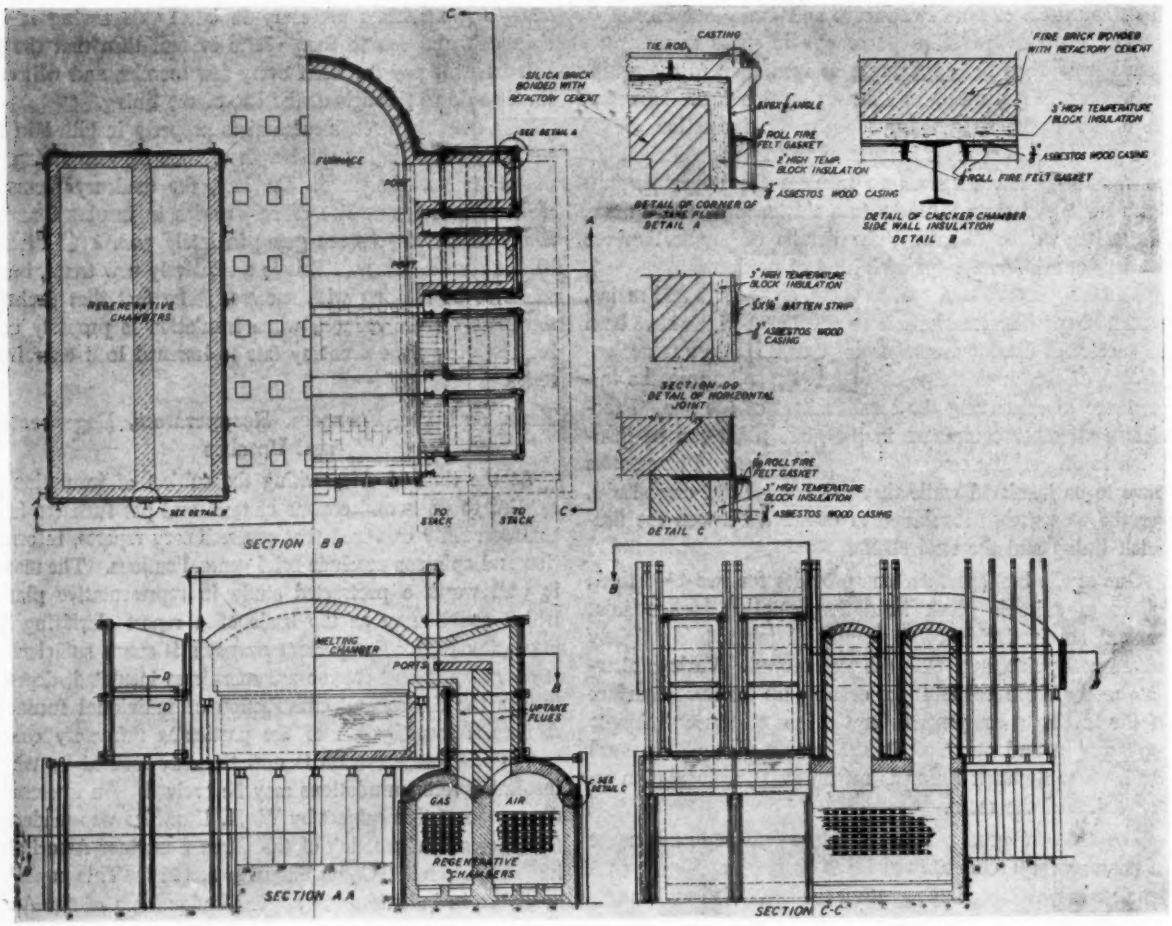


FIG. 4—DRAWING ILLUSTRATING THE APPLICATION OF INSULATION TO GLASS TANK REGENERATORS, PORTS AND UPTAKES

that it seems profitable to include in this paper an analysis illustrating the economy of heat conservation in connection with the regenerators. The heat conserved by reducing radiation losses may be evidenced by a direct saving in fuel, and increased production or a greater speed in making the heats. The losses incidental to shut-downs are decreased and improved conditions result from the reduced leakage through insulated regenerator walls. Refractory loads are lightened, more uniform temperatures exist throughout the checkers, and maintenance charges are smaller. Some of these effects are intangible, but nevertheless operate to the advantage of the installation. If it were shown that heat saving alone justifies the necessary expenditure for insulating materials to fulfill the above specification, then it would be apparent that the insulation of regenerative chambers is highly advisable.

An illustration which serves the purpose may be worked out on the basis of constants computed by Professor W. Trinks for a particular set of uninsulated regenerators preheating cold producer gas and air from a temperature of 60° F. In this case the temperature of preheat was approximately 1200° F., the flue gas entered the checkers at 2200° F. and the average temperature of the flue gas in the regenerator was 1700° F. The heat transmssion between flue gas and checkers was found to be 2.5 B. t. u. per square foot per degree F. per hour, and the corresponding coefficient between checkers and air was found to be 1.85.

In working up this data it will be assumed that ground level is at the floor of the checkers. Heat loss from the outside surface of the uninsulated regenerators is about 212 B. t. u. per hour per square foot of regenerator heating surface. This heat loss is numerically equal to the difference between the average quantity of heat absorbed from the flue gases and the average amount of heat picked up by the air and cold gas. If "X" is the mean effective temperature of the checkers, then for uninsulated operations:

$$2.5\ (1700 - X) = 1.85\ \left(X - \frac{60 + 1200}{2}\right) + 212.$$

$$X = 1200°\text{F.}$$

Suitable insulation in accordance with the recommendations noted above, reduces heat wasted from the exterior of the regenerator to less than 40% of the uninsulated loss. The effect of this reduction is to increase both the flue gas temperature out of the regenerators and the temperatures of preheat.

Since the weights of the preheated gases and the flue gases

are the same, and the weight of specific heats are approximately equal, then the percentages of heat saved by insulation appears in the preheated gases and the flue gases in ratio of their temperature range.

Preheat range = 1200 — 60 = 1140°F.
Flue gas range = 2200 — 1200 = 1000°F.
Heat recovered by insulation = .6 x 212 = 128 B.t.u. per square foot of regenerator heating surface.

Heat available to increase air temperature by virtue of insulation $= \frac{1140 \times 128}{1000 + 1140} = 68$ B.t.u. per square foot of regenerator heating surface.

Heat transfer to the preheated gases in an uninsulated regenerator = 1.85 (1200—630) = 1055 B.t.u. per square foot of regenerator heating surfaces

If 1055 B.t.u. per square foot raise preheated gases through range of 1140°F. then (1055 + 68) B.t.u. will raise them through $\frac{1140\ (1055 + 68)}{1055} = 1223°F.$

Discharge temperature of preheated gases from the insulated checkers = 1223 + 60 = 1283°F.

About .75 pounds producer gas is required per pound of air, and in the above example .31 pounds of air was fired per second per million B. t. u. per hour left in the furnace. For every million B. t. u. left in the furnace a quantity ot gas must be supplied to contain the following number of heat units:

.75 x .31 x 3600 x 15.65 x 150 = 1,970,000 B. t. u.

With producer gas worth $.25 per million B. t. u., then each million B. t. u. left in the furnace is worth:

$$\frac{1{,}970{,}000}{1{,}000{,}000} \times \$.25 = \$.49$$

If weight specific heat be assumed at .25 the insulation of regenerator saves the following sum per hour for every million B. t. u. per hour left in the furnace:

$$\$.49\left[\frac{3600 \times .31 \times .25\ (1 + .75)\ (1283 - 1200)}{1{,}000{,}000}\right] = \$.02$$

In the above described regenerator there were 312 square feet of combined external regenerator surface for every million B. t. u. per hour left in the furnace, which would be insulated at the average cost of $.52 per square foot in accordance with the above specification.

Total cost of insulating 312 square feet $.52 x 312 = $162.50.

Assuming operation to extend over 8,000 hours per year the equivalent fuel saving per year per million B. t. u. per hour left in the furnace amounts to:

$.02 x 8,000 = $160.00.

This makes the gross return on insulation investment during the first year through heat saving alone equal to:

$$\frac{160.00}{162.50} = 98.5\%$$

It is at once apparent from the above example that the conservation of waste heat is by itself more than sufficient to justify the expense of insulation. In this case the disbursement is returned in one year's time. The advantage of insulation incidental to reduced air infiltration and lessened maintenance expense result in important corollary savings which amount to so much more clear gain.

Annealing Furnaces and Lehrs

The matter of insulating annealing furnaces and lehrs does not readily lend itself to the preparation of standard specifications, chiefly because of variations in furnace design, fuel costs, hours of operation, etc. As thickness of insulation is increased the cost of heat lost per year is decreased, but the cost per year of insulation (first cost multiplied by percent fixed charges), is increased. The thickness at which the sum of these two costs is a minimum is obviously the most economical. A characteristic example of the computation involved will serve to make the analysis clear. A graphical method of approximating the same result is discussed in the foregoing paragraphs and a complete study of the analytical method appears in a paper by L. B. McMillan on "Heat Transfer Through Insulation in the Moderate and High Temperature Fields: a Statement of Existing Data.[3]"

Suppose the heating zone of a glass lehr is considered. Here the safe temperature limits of refractories are never reached and neither is the temperature great enough to affect high temperature insulation disadvantageously. The economical thickness of insulation may be determined from the equation:

$$X = \sqrt{\frac{a\ k}{b}} - k\ (R_1 + R_2 + R_3 \text{ ————})$$

in which "x" is the economical thickness, "k" is the conductivity, "b" is the cost of insulation per inch thickness per year, "R_1 R_2 R_3" etc., are the resistances of all the other elements, including surface, resistance and—

$$a = \frac{Y\ (t_o - T_a)\ M}{1{,}000{,}000}$$

in which "Y" is hours operation per year, "t_o" is inside temperature, "t_a" is temperature of surrounding air, and "M" is the value of furnace heat in dollars per 1,000,000 B. t. u.

For a cheap fuel, the furnace value of which is $.25 per million B. t. u., assume an inside temperature of 1080°F. and room temperature of 80° F., with hours of operation 8760 per year—

$$\text{Then } a = \frac{8760\ (1000)\ .25}{1{,}000{,}000} = 2.2 \text{ approximate.}$$

Suppose the construction is made up of 13½" fire brick, whose conductivity in this case would be about 6 B. t. u. per square foot per inch thickness per degree F. temperature difference per hour. If an asbestos wood casing is presumed for the protection of the insulation, outside surface resistance for heat passing to still air would be about .45:

Resistance of fire brick = $\frac{13.5''}{6 \text{ B.t.u}} = 2.25$

Surface resistance = $\frac{.45}{2.70}$ Total resistance of items other than insulation.

Cost of insulation per inch thickness per year, the item "b" is of the order of $.05. Assume that insulation has been selected whose conductivity at these temperatures is about .625 B. t. u. Then the economical thickness:

$$X = \sqrt{\frac{2.2 \times .625}{.05}} - .625\ (2.70) = 5.25 - 1.69 = 3.56''$$

(3½" thick insulation, the nearest commercial thickness, would be used in this case)

[3] See Transactions A. S. M. E. 1926, page 1300.

It is obvious that the cost of heat is a vital factor in determining economical thickness of insulation. In an electrically heated lehr this might amount to 18 or 20 inches.

Preheating Arches, Glory Holes, Flattening Furnaces, Etc.

Other furnaces used in connection with the manufacture of various kinds of glass products are insulated in accordance with the same principles outlined in the foregoing paragraphs. Many obsolete types of furnaces are still found in the older plants, and it is needless to say that defects inherent to furnace design cannot be corrected by means of insulation. It is true, however, that where temperature differences within the furnace result in uneven heat treatment, much can be done to improve conditions by insulating those portions which tend to remain at temperatures too low to produce the desired result when other parts of the furnace are adequately heated. Suitable insulation properly applied saves fuel by conserving heat that is otherwise wasted, obviates leaky walls, makes for lightened refractory loads, thereby reducing maintenance charges, betters the appearance of the job, and greatly improves working conditions and labor efficiency by keeping the heat inside the furnace where it belongs. Many obvious uses suggest themselves to men whose interest lies in protecting themselves from high temperatures. Wherever untoward conditions result from presence or absence of heat, it is logical to inquire as carefully and completely as possible into the possibilities of insulation.

Conclusion

The history of glass manufacture is replete with instances where changing conditions and exceptional demands have stimulated the industry to a precocious development, only to follow with times of depression and readjustment when the growth-activating influences cease to exist. During these latter periods the glass producer is faced with the unhealthiest kind of competition, and can maintain his position in the markets of the world only by resorting to every possible economy of manufacture, and by enlisting the services of science in providing his plant with improved means and methods.

It is true that the same order of equipment and facilities that are of vital importance when competition is keen, will increase profits when the market is ready and business is good. Management cannot afford to maintain an indifferent attitude if the next year may force measures which could be beneficially adopted today.

One perfectly definite method of increasing economy of plant operation has been discussed in the foregoing pages. Delays in carrying out suggested improvements of this sort not infrequently entail losses greater than the proposed expenditure. The importance of suitable furnace insulation properly applied should receive the attention of all glass manufacturers.

Chemistry of Glass

By W. C. Taylor

This paper, presented at the September meeting of the Glass Container Association at Montreal, Canada, by Dr. Taylor, chief chemist of the Corning Glass Works, discusses the principal kinds of glass in general use and briefly points out the lines along which progress in glass chemistry probably will be made in the future.

The chemistry of glass being a relatively new branch of science, there are still many reactions not yet satisfactorily explained. Much more research work is needed. Now that commercial glasses free from alkali and also free from silica have been produced new terms are needed with which to define glass. Lime, lead, borosilicate and colored glass are discussed.

WHILE glass making is a chemical industry which has existed for at least 3,000 years the application of the science of chemistry for improvement in glass making dates back less than a century. The first work we have knowledge of is that of Harcourt started in England about 1834. This was followed some 50 years later by the valuable work of Schott and Abbe at Jena on the correlation of chemical composition with the physical properties of glass. Rule of thumb methods and secret formulas held to be of great value and passed on from father to son were long responsible for a lack of understanding of glass chemistry, and it is only since shortly before the beginning of the present century that much progress has been made. You can, therefore, see that the chemistry of glass is a relatively new branch of science. There are many reactions not yet satisfactorily explained, and much additional research work is needed before we have the complete story of the chemistry of glass.

An old definition of glass that I learned in school says "Glass is an amorphous, transparent or translucent mixture of silicates, one of which is always an alkali." This definition covers a multitude of compositions, but we shall have to devise a new one as we now have commercial glasses free from alkali and also free from silica.

The term glass, hard as it is to define, has always carried the impression at least of compositions of the inorganic field but during the last few years attempts have been made to extend the designation "glass" to certain organic substances which at least visually resemble the old-fashioned silicate glasses. A modern definition therefore, would be that glass is a supercooled liquid that in composition may range from a pure element such as selenium or pure oxide such as silica to a complicated mixture of oxides or other compounds.

Now while the Glass Container Association is interested primarily in soda-lime-silicate glasses which I will take up in some detail it is probably worth while to first discuss briefly some of the other glasses.

The organic glasses are still of no great commercial importance but development along this line should be watched as there is a remote possibility of something worth while being done in this field. Claims are made for the organic glasses that they have greater elasticity and strength, and they may also have some advantages where lightness in

weight is a factor, or where ultraviolet transmission is desired. So far these glasses show many defects. While it is true that they are very tough and resilient when new they are slowly affected by age, weather and light with consequent loss of strength. They are also scratched more readily than ordinary glass, and lose their transparency due to scratching, effect of light, effect of water or a combination of all these. Their solubility in certain chemicals, the fact that they cannot be used at temperatures much over 200°C, and their high cost of manufacture are additional factors holding back the commercial exploitation of such glasses.

Alkali-free inorganic glasses have some advantages in chemical and electrical properties which may find a limited application although these glasses have certain disadvantages from the manufacturing standpoint in regard to melting and working. Silica-free inorganic glasses lack in general the durability of silica glasses but may find some limited application where special physical properties are desired, and where the lack of durability of the glass can be overcome by surrounding conditions or must be put up with as a necessary evil.

Now to get back to our good old-fashioned silicate glasses. These can be separated into four general types which we will call lime, lead, borosilicate, and colored glasses. The greatest of all these in tonnage is lime glass, the basis of the window and plate glass industry as well as the glass container field. While lime glass has its limitations its cheapness combined with reasonable durability and good resistance to weathering has made it the most widely used of all glasses.

In its simplest form it is a fused mixture of sand, soda, and lime. The percentage of each constituent may vary according to the use of the glass, and other elements may be added or substituted to improve certain properties. These changes usually increase cost, and are made with some definite advantage in mind. While the best lime glasses center around the molecular proportions of Na_2O-CaO-$6SiO_2$ we cannot give glass a definite chemical formula, but have to consider it as a mixture of oxides or silicates. Various attempts have been made to determine the constitution of glass without a success. Morey and Wyckoff[1] even attempted this by x-ray methods with inconclusive results. Although these authors established a structure for the compound Na_2O-CaO-SiO_2 and others, they found the pattern obtained from a glass, even though it be of the composition of a pure crystal, was different in pattern from the crystal.

Several slides were here shown and discussed. Among these were shown the chemically stable and mechanically strong glasses in the ternary system Na_2O-CaO-SiO_2. Variations in melting points, viscosity, density and refractive index were also shown for the same system.

In a general way it can be said that soda is used primarily as a flux to aid in melting, and its use is limited by the fact that it makes the glass more soluble and less resistant to weathering. It raises the coefficient of expansion thus making the glass more difficult to work without checking, more difficult to anneal, and less resistant to temperature changes, or in other words more brittle. The surface is also not as tough, and scratches more readily. Lime also serves as a flux at melting temperatures, and has a beneficial effect on the chemical resistance and surface hardness. In excess, however, it may lead to crystallization and too quick a setting rate so that the glass does not have the proper working range. Silica while raising the melting temperature is necessary in considerable percentage to obtain a durable glass of good working qualities. Excessive silica results in a glass too hard to melt and with a tendency to crystallize. Too little silica if combined with excessive soda gives too soluble a glass, if with excessive lime too quick a setting rate.

With these limitations the next step is to consider what other elements may be added or substituted. Potash may be substituted in part or entirely for soda at a decidedly increased cost. For ordinary use it has no advantage and some disadvantages. It is not as good a flux as soda, and it makes a glass of even lower surface hardness. It has some advantage in changing the viscosity curve, and in preventing devitrification. Lithia would have some advantages as a substitute for soda if it were not so expensive as to be prohibitive for ordinary use. It has much greater fluxing power offset by a greater tendency to devitrification.

As a substitute for lime, magnesia is the element most frequently used. A mixture of calcium and magnesium oxides in about equal proportions gives a softer and a lower melting glass with a better working range than is obtained with either oxide alone. The fluxing action of magnesia is about the same as lime, and it has, therefore, been found advantageous in many cases to use magnesia limestone rather than pure lime, although not generally considered worthwhile to go to the expense of adding MgO as such to further increase the ratio of MgO to CaO. Barium and zinc may also be substituted but because of their expense are not used except where special properties are desired.

There is no element which we exactly substitute for silica, although alumina might be considered in this light. The use of small amounts of alumina has become more and more popular of recent years. It has the advantage of promoting chemical resistance, and toughness, and tends to prevent crystallization. Its hardening effect is greater, however, than that of silica, and if used in large amounts makes a glass difficult to fuse and difficult to work. It is also more difficult to obtain alumina glasses homogeneous and free from striae. Traces of alumina are present in all glasses, and are obtained from sand and from the clay refractories with which the melting glass is in contact. The alumina thus obtained may vary from .1 per cent up to slightly over 1 per cent without having been deliberately introduced.

In addition to the major constituents such as soda, lime and silica we have numerous minor constituents which formerly were not given much consideration but which have in many cases been shown to be of importance. Most important of these is perhaps alumina which I have just discussed. Other common impurities are small amounts of sulphates and chlorides, traces of water and carbon dioxide, fluorides, titanium and iron oxides and sometimes many others. Arsenic is usually introduced as a clarifying agent and sometimes antimony or boric oxide is added in small amounts.

[1] *Journal of Society of Glass Technology*, 9-256 (1925).

The general rules that I have stated to you regarding the main glass constituents are at the present time quite well known and some work has been done on the effect of minor impurities. About these, however, we still have a lot to learn. It seems to hold generally true in glass chemistry that small traces of an element exert an influence on the glass in greater proportion than larger amounts. This is noticeably true of such constituents as alumina and boric oxide. Of course, in amounts of less than 1 per cent impurities did not exert enough influence to attract the attention of the glass workers of ten and twenty years ago, but in the present of highly developed and sensitive machines, and of more rigid requirements in standardized product influences which were formerly negligible became of importance

Studying the effect of some of these impurities and the effect of small variations is by no means easy and involves in most cases much labor in working out new methods of analysis and new test methods delicate enough to measure the small amounts and small effects.

Before closing I wish to briefly discuss the other three types of silicate glasses in order to complete the story.

Lead glass is not as common as lime glass chiefly because of its higher cost of materials. Lead glass formerly held a considerable market as tableware being used not only for cut glass but for plain ware as well. It was also the glass used for bulbs and tubing for the electric lamp industry and for railroad signal glasses. Its use has been much reduced in recent years by improvements in the cheaper lime glass. The change from lead to lime glass in the electric lamp industry was the result of many years' work by the Corning Glass Works Laboratories, and makes too long a story to be told here in full. Briefly, however, lead glass had certain decided advantages such as low melting temperature, long working range, and fairly high electrical resistance. Its big disadvantage was that it did not lend itself to machine operation because it seemed impossible to get good quality lead glass from tanks. A non-lead glass was finally developed which could be used in lamps, and eventually proved to be superior to lead glass for high speed machine production. Lead glass is still used for some special purposes such as optical glass and electrical tubing where its electrical resistance, its extra softness or its high refractive index make its use necessary. I might add at this point that after the change to non-lead bulbs had taken place special refractories were developed at Corning which enable us today to successfully melt lead glass in tanks for the production of electrical tubing.

Borosilicate glass is made primarily where resistance to heat shock, or chemical or electrical resistance is needed. Because of its higher cost its use is limited to those fields where these special properties are required.

Colored glasses while but a small part of the glass field involve a very considerable amount of glass chemistry. There are two types of color one of which is not affected by working conditions and is dependent on chemical composition for its uniformity. The other type in addition to chemical composition is dependent on a time-temperature cycle. In general the colors of the purple-blue-green end of the spectrum are produced by the use of direct coloring oxides not influenced by heat treatment. The oxides commonly used are, nickel or cobalt for purple, cobalt with copper for blue, and copper or chromium or both for green. Many other oxides such as manganese, iron, titanium, cerium, vanadium, uranium, etc., are used in special cases for variations. Yellows are made most commonly with iron and carbon but can be produced in almost an infinite number of ways. Some yellows are appreciably affected by heat treatment while others are not affected at all. Reds are produced by either gold, copper, or selenium and all of these colors are very materially affected by heat treatment. White or opal is usually produced by fluorides or phosphates but can be produced in other ways. Practically all opals are dependent on heat treatment.

The story of colored glass is so complicated, and of such minor interest to the Glass Container Association that I have only briefly outlined it. A small percentage of glass containers are today colored or tinted so as to retard the effects of certain light rays in the foods, chemicals, or beverages contained therein.

In closing I would just like to sum up some of the lines where further chemical work will improve the industry. First of all we need less soluble refractories for pots and tanks as these are now a source of contamination varying somewhat from day to day thus influenceing the physical properties of the glass and causing non-homogeneity and glass defects. There is further work to be done on obtaining the ideal glass for machine operation in respect to cost of materials, melting cost, workability, less tendency to devitrify with less attack on refractories, and with still greater durability. Progress along these lines will probably be obtained by a more complete study of the effect of such volatile or semi-volatile impurities as water, carbon dioxide, chlorine, sulphates, phosphates and fluorides and the effects of small additions of more expensive elements.

Testing the Big Telescope Reflector

Readers who have followed the history of the large glass disk manufactured by the Bureau of Standards at Washington for use as the mirror of a reflecting telescope to be erected at the Ohio Wesleyan University, as depicted in photographs reproduced at intervals in these pages showing the casting, annealing, grinding and polishing processes used in making the big piece of glass and the drilling of an eight-inch hole through its center, will be interested in the following account of a test of the disk made for strain, as described recently in the *Technical News Bulletin:*

The disk was stood on edge and examined for "strain" or quality of annealing by means of plane polarized light. The strain was found to be symmetrical with respect to the shape of the disk, and the maximum strain detected produced a relative retardation equivalent to 6 millimicrons per centimeter thickness. This is well within the maximum strain permissible in optical glass used in high-precision instruments.

The hole was drilled with an 8-inch brass tube attached to a radial drill press. Although the quality of annealing indicated that this hole might be made without danger of breaking the glass, precautions were taken to protect the optician in case the glass did "explode." These consisted of bedding the glass on sand, surrounding it with a cast iron ring and covering it with planks and sheet steel except for the hole through which the cutter worked. The purpose of a hole in a reflector is to permit the use of the Cassegrainian type of mounting in which the partially converged light is reflected by a secondary mirror back through the hole to the observer's position. A reflector with a hole in it can still be used with either a prime focus or Newtonian type of mounting, and hence this disk can be used for any of these three types.

On the Road to Better Design

Notes on Realizable Aims in Our Industrial Arts

By Richard F. Bach[1]

A LAME muscle in an otherwise healthy working arm—that is the present position of art in industry. The muscle is not weak through overwork; not atrophied because unused; it is merely fatigued through misuse. The prescription: well-ordered, carefully studied exercise, the dose increased slowly until the member is brought again into articulate harmony with its associates and the rounded effectiveness of the arm restored.

Considering the present condition, experience, and purse of the patient and the extreme lameness of the muscle, what is the form of exercise best calculated to bring him relief?

It is the chief fault of discussions regarding the present status of art in industry and commerce that blame is too readily fastened upon but one agent in a situation involving several, whose combined efforts produce the conditions complained of. Manufacturer, dealer, school of design, and the purchasing public all are parties to what has been termed a conspiracy against public taste. It must first be recognized that each of these must take stock of its sins, which are chiefly those of omission, and of its virtues, which are chiefly of the passive variety designated by white, not of the temptation-conquering kind shown in art by red.

And, secondly, it must be recognized that no remedy proposed can be successful, indeed, can be put in operation at all, if its effect is to be that of a caustic. The cure must be gradual, the poison slowly expelled from the body industrial and the body commercial, although the process may be aided by tonics.

Manufacturers, dealers, and public alike must be brought to a keener realization that in the art industries design is the chief selling factor, the basis of first appeal. This is true at all stages in the life history of architecture and of furnishings, clothing, jewelry, and every other form of industrial art. To achieve this understanding of design will require not only knowledge but conviction on the part of all concerned.

Thus the manufacturer should be willing to co-operate with schools of design, to serve on their directing boards, advising in the preparation of programs of study; also to aid the general purpose by admitting graduating students in the semester or year preceding commencement, as apprentices on part or full time, to his designing rooms with periodic instructional visits to his factory, that design may always be visualized as unhampered by the limitations of portraiture and the obstacles presented by paper and tubes of color.

Again, the manufacturer should be willing to grant his designers time on pay to study their current problems in terms of the best sources in nature and in museums and libraries, to meet them himself regularly in group conferences to inform them as to market conditions, provide them with both art and trade journals, and more than occasionally turn out objects designed by them, or by others, which are beyond the bread-and-butter type of commercial achievements.

The dealer, in turn, should be willing to instruct his "buyers" and his salespersons as to the importance of design as a selling factor, profiting through courses offered by museums, schools, or individually employed experts to obtain the necessary guidance. He should be willing to handle certain commodities which are unquestionably of fine design though not sold in quantity or even at reasonable profit. His window display, advertisements, price cards, all should bear out the same point, that his sales are based not only on material, serviceability, and price, but also on appearance, which is design. To prove his sincerity he should be willing to employ an art director, regularly or on special terms, to supervise all such matters and advise in the correct appearance of his establishment and wares before the public. But the training of taste in his buyers and salespersons should be his primary concern.

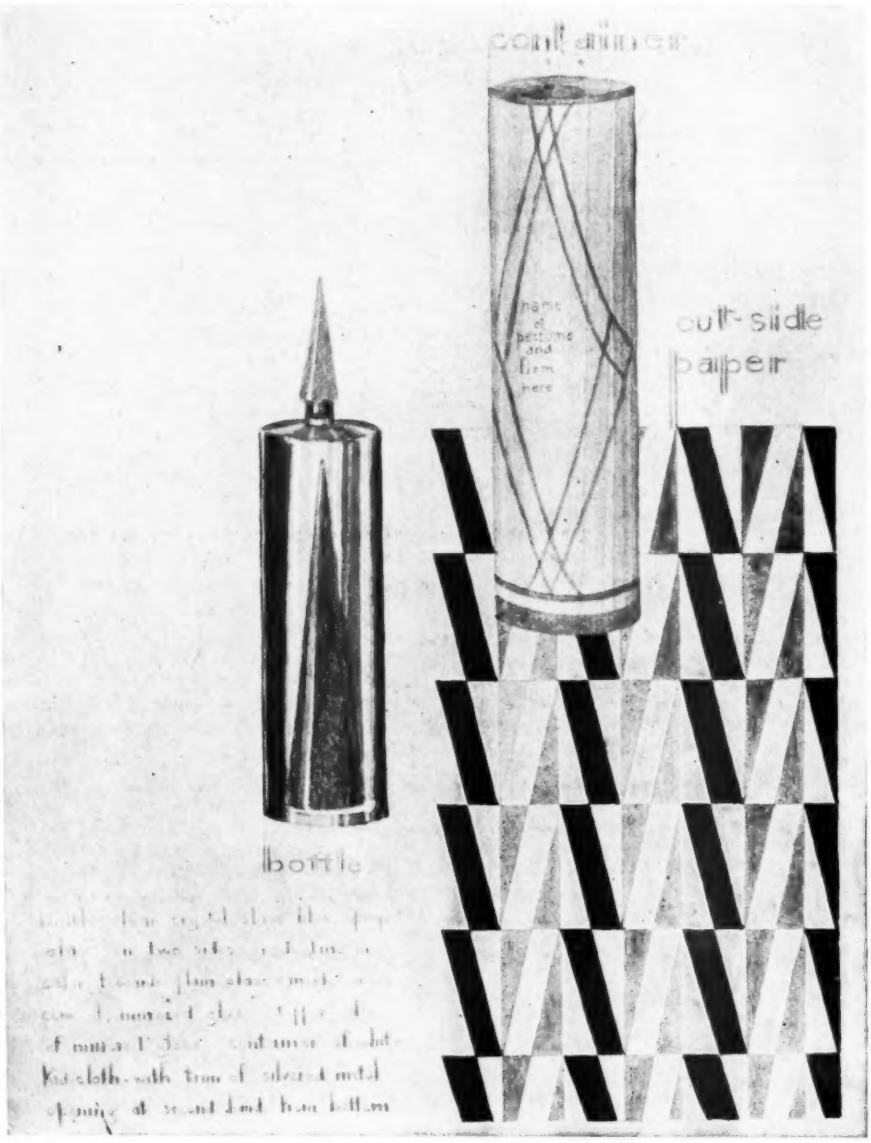
Schools of design, as a group, are out of tune with present needs and practices in industrial art; they are hedged in by walls of paper and pickets of drafting instruments. They need to hear the noise of machinery, to discover what happens to highly finished portraits of wallpaper, cretonne, and other patterns when fed into the maw of quantity production. They need to learn that practical training of students does not mean occasional trips to factories to see the wheels go round, but the actual installation of some machinery in the school, the actual execution of designs under their maker's personal supervision in a working plant.

Schools of design will in future study market demands, teach design for industry in terms of what will sell, doing this, however, always with an eye toward bettering factory output. Again, schools will cooperate with manufacturers and dealers, asking their advice (and following it) and selling to them designs immediately useful with minimum modification. For the students of industrial design, schools will be closely related with selected firms, so that prospective graduates can finish their schooling with a stated period of factory or store employment, in close contact with the realities of art in labor—a sort of blending period to furnish a check-up of theory by practice. Finally, to aid both manufacturers and dealers, and their employes, schools can and will with profit offer continuation courses on various aspects of art useful in production and trade.

In the whirr of modern machinery the craftsman is often lost sight of; in part this is his own fault. He cannot compete with the machine; his greatest asset is to know this. But he can control the machine! If he wishes to remain a craftsman in the true sense the world will call him blessed. But if he cannot afford to do this, let him turn his craftsman's training to productive use by working in a factory.

(*Continued on page* 255)

[1] Associate in Industrial Arts, Metropolitan Museum of Art, New York.—(From the Bulletin of the Metropolitan Museum of Art.)



Design by Claggett Wilson

Awarded first prize of five hundred dollars in the competition for a design for a perfume bottle, sponsored by the Art Alliance of America.

A perfume bottle with container and wrapper designed in keeping with it.

Prize-Winning Designs

THE awards in the invitation competition sponsored by the Art Alliance of America in which six well-known American designers participated, submitting designs for a perfume bottle, were announced on October second.

An object of the competition was to obtain American designs for perfume bottles which would compare favorably with the beautiful modern French bottles designed by Lalique and other famous artists.

The first prize of five hundred dollars went to Claggett Wilson for a design which included an ensemble of bottle, container and wrapper. The bottle, a simple cylindrical form with a silver cone-shaped stopper, is to be developed in blue, silver and crystal. The wrapper repeats the same color scheme in a striking modernistic pattern, while the unornamented white kid container gives a note of elegant simplicity. The second prize of two hundred and fifty dollars went to Gustav Jensen for a series of designs notable for their individual interpretation of the simplified forms characteristic of the

Design by Gustav Jensen

Awarded second prize of two hundred and fifty dollars in the competition for a design for a perfume bottle, sponsored by the Art Alliance of America.

The prizes were donated by Mr. and Mrs. Carleton Palmer.

for Perfume Bottles

modern style. Honorable mention was given by the jury to Walter Teague for a series of designs, containers and wrappers to be developed in schemes of silver, black and gold. The beauty of Mr. Teague's designs was mainly dependent upon the finely balanced proportions of his unornamented surfaces.

These prizes were donated by Mr. and Mrs. Carleton Palmer. The Jury of Award was as follows: Richard Bach, Associate in Industrial Art, the Metropolitan Museum of Art; Mrs. Edna Woolman Chase, editor of *Vogue;* Mrs. Helen Appleton Read, assistant director of the Art Alliance of America; Paul Hollister, designer; Kenneth Hayes Miller, painter, and Frederic Carder, expert technician in glass.

The idea underlying the competition was not only to give the American designer the opportunity for proving his ability to inject new elements of design into a commercial product, but also to prove that when American industry and native designers cooperate, the quality of the product is immediately enhanced—a fact already proven in Europe and the cause for the high standard of design to be found in the European industrial arts.

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American Glass Industry Needs Trained Decorators

Modern industry realizes more and more that as a people, we have entered upon a new era. The days of the pioneer are gone, never to return. With the general increase in wealth has come a demand first for greater luxury, then for art. Unless American industry can satisfy these demands, it is at a disadvantage in foreign competition, from countries where native art is as vital to the people as the soil they live on, and the air they breathe. The demand for good design, appropriate decoration, attractive color must be met if we desire to hold our own.

Particularly is this true at this time of the glass industry. It is the ability to satisfy the demands for artistic glassware that has been used to great advantage by French, Swedish and German glass manufacturers, to get a strong foothold in this country with a success that is wholly deserved.

While structural and shape design of glassware in this country has shown remarkable development of late, we are woefully lacking in the art of decorative design or surface enrichment of glassware. This art was originally started in the United States by European decorators and decorative ideas in the majority of glass factories are still dominated by them. It is a well known fact that the majority of men in charge of decorating rooms are trained in the European traditions, if not directly, then by contact with foreign trained decorators.

The artistic side of glass manufacturing is little understood by the American glassmaker-executive of today. It is left almost entirely in the hands of the decorator. While the decorator in the average glasshouse may be properly qualified to take care of the work required of him, he usually has no time and finds little encouragement to do creative work. On the other hand, the artist accustomed to pen, pencil or brush, artistry on paper or canvas does not qualify as a designer and decorator of glass. Those who attempt to do this work often produce designs that are pleasing to the eye, but impossible to execute. The average artist does not and cannot be expected to realize both the possibilities and the limitations of the medium which he uses to express his ideas. What is needed is a thorough knowledge and understanding of cutting, etching, engraving and chipping of glass, the spraying, stenciling or stamping of the glass surface by means of vitrifiable colors, stains, lusters, and metallic decoration. The successful artist in glass needs the thorough training in art and design of the art school, and in addition an apprenticeship in a glass factory or a school where the various types of decorating named above can be learned in a practical way.

In this country we lack such a school or training course for applied art, hence the dearth of experienced decorators. If the glass manufacturers, especially those of the tableware and lighting unit industry, do not soon recognize the present situation they will find that the few existing trained decorators will not easily be replaced. The filling of these places by younger men, lacking the background of training, environment and tradition of their teachers will mean that the standards of American decorated glassware will

sink to lower levels. This condition is especially appalling at a time when European decorative glassware is winning additional laurels. Witness the efforts of such factories as Orrefors in Sweden, Leerdam in Holland, Lalique, Marinot, and Goupy in France, Oertel in Germany, to mention only a few. The American glass industry could accomplish much if we were possessed of the spirit that moves the European glass manufacturer of to-day. We do not refer particularly to glassware of the highly decorative and expensive type, but to everyday glass articles of utility, produced under American production conditions. This refers to stemware, ordinary pressed and blown tableware other than stemware, lighting units and shades of all descriptions, popular priced glass lamp bases, vases, and containers for perfumes, cosmetics, etc.

The public is becoming more critical of structural and decorative design of articles of every description and if our own factories cannot supply their needs, they will continue to buy abroad. Especially in the glass industry this condition prevails to a greater extent than is justifiable. We should therefore recognize the fact that there already exists a deficit of trained glass decorators in this country, and that the urgent need of the moment is to raise up a younger generation that will carry on their work and that is able to sense the trend of new times. There is no good reason why the glass manufacturer and the art schools cannot get together towards the establishment of an applied art course, or a training school where the various processes used in glass embellishment can be learned and applied in a manner suitable to mass production methods.

Until this is done, there is little hope for the establishment of a higher level for American made decorative glassware, or even the maintenance of present conditions. The glass industry is face to face with a serious situation: to care for the perpetuation of its work in years to come, which is in real danger, due to lack of training facilities for those who are to carry on.

On the Road to Better Design

(*Continued from page 251*)

This is not heresy, for the modern factory differs not in purpose, only in method, from the old *bottega*. A loom is still a loom, no matter how complex or by what power driven; if design is lacking it is the fault of those who own and operate the loom or who buy its products. The craftsman can aid the manufacturer and so help us all by designing for these machines, making in the round as well as on paper that first model whose form is to be reproduced in mass. Industry is not the enemy of craftsmen; it is their great opportunity.

And for the public? In the course of decades schools and colleges might make some impression on the mass of the buying public, if these institutions were all to begin at once to give instruction on "how to buy," in terms of design. But the real benefit to public taste will come by the shorter route through the manufacturer and dealer, relayed to the ultimate consumer in concrete form in the objects of industrial art which he buys and uses.

Until these lines are in operation the press can help; not by heavy historical or theatrical articles, but by more popular matter having to do less with the "what" than with the "how" of design in the making and the "why" of design when it reaches the point where, to produce more of its kind, it must be exchanged for salary and savings.

A game worth playing is a game worth learning. We are all players whether we happen to be makers, sellers, teachers, or users of the industrial arts. Unless every member of the team knows his place, his work, and especially his responsibility, the success of the unit will always be problematical, surely retarded. To restore art to industry, without taking the industry out of art, will be the great work of the next half-century in our country.

The Art Alliance an Aid to Manufacturers

The Art Alliance of America, founded in 1914 to afford through its Placement Service, its exhibitions and industrial art competitions an effective link between art and industry, is developing today into a clearing house for the industrial arts where the manufacturer in need of the artist designer, and the designer who must put his creative ability and knowledge to work, are put in touch with each other to their mutual advantage.

Every American manufacturer realizes today that what is termed the "modern" style must be definitely reckoned with. It has been accepted and it remains now to develop it on sane and practical lines. Much that has so far been presented in America is merely freakish and bizarre and as such must necessarily be ultimately rejected by the public with a consequent loss to the manufacturer. With this situation in mind the Art Alliance has assembled under its auspices a group of experts in design, conversant with the best work, both in this country and Europe and is offering their services to the manufacturer who wishes to improve the standard of his output and to meet the demand for fresh contemporary design in his particular field.

This service offers special facilities to the out-of-town manufacturer whose time in New York is limited, for arrangements may be made in advance of coming to New York for appointments with designers and experts of proved taste and ability, whose work is best adapted to his particular needs.

This department is only one phase—though an important one—of the work carried on by the Alliance in its offices at 65 East 56th Street, New York. It has a membership of about a thousand artists, craftsmen and designers whose work covers practically every phase of the fine, applied and graphic arts.

During the season it holds in the Art Center Galleries, exhibits in black and white, watercolors and oil, decorative art and textile design, as well as a large Annual exhibition and sale of greeting cards designed by well known artists.

For a number of years the most important textile houses in America have offered prizes in the Annual Textile Design Competition sponsored by the Alliance, and the furniture, rug, wallpaper and other trades have sought through valuable cash prizes offered in Art Alliance design competitions to uncover fresh sources of creative design in this country with such success that several of these competitions have become annual affairs.

The Placement Bureau, whose enrollment ranges from apprentices to experts, is ready at all times to take care of the needs of organizations or individuals in any field of the fine or applied art.

American Ceramic Week

The objectives of the American Ceramic Society meetings and the Ceramic Exposition to be held at Chicago next February are directed to making Americans conscious of the fact that American ceramic wares are inferior to none—as economical as any—and should be purchased and used more freely. The fact will be emphasized that the buying of American products will give the purchasers the maximum in quality desired at as reasonable a cost as possible and will at the same time bring profit to the American people generally through patronage of American industries. The appeal to producers will be for maximum quality and minimum costs and to the ultimate user it will be on quality, cost and economies.

Head of Famous Glassworks Nominated for U. S. Senate

Alanson B. Houghton of Corning, New York, Notified of His Selection

Alanson B. Houghton, United States Ambassador to England, chairman of the executive committee of Corning Glass Works, and interested in many other activities, whose nomination by the Republican party for United States Senator from New York was effected some weeks ago, returned from England on October 11 and on October 13 was warmly welcomed to his home town,

AMBASSADOR ALANSON B. HOUGHTON WITH HIS SON AMORY WHO IS ALSO ACTIVE IN THE MANAGEMENT OF THE CORNING GLASS WORKS, PHOTOGRAPHED ON HIS ARRIVAL AT NEW YORK ON THE MAURETANIA

Corning, New York. On October 20 formal notification of the nomination was given to him at a large and enthusiastic meeting attended by party leaders from all over the state, workers from the Corning Glass Works, citizens, and farmers and their wives from the surrounding country. It was a great day for Corning and the celebration constituted a most auspicious opening for the candidate's campaign. The formal notification was delivered by Frank L. O'Brian of Buffalo, who spoke of the splendid "qualities of energy, fairness and honorable dealing which for generations have made the Houghtons of Corning conspicuous as conscientious, earnest, hardworking, God fearing citizens." He emphasized that Mr. Houghton's career as a successful business man and as Ambassador to Germany and then to Great Britain had eminently fitted him to represent the interests of the State of New York in the Senate.

ACCEPTS NOMINATION

State Senator Fearon, who unsuccessfully contested the nomination with Mr. Houghton told his hearers that they had elected "the best man" and promised his full support. In accepting the nomination Mr. Houghton addressed the audience at some length. He spoke of the many serious issues involved in this campaign. He said of Mr. O'Brian's reference to his years of service abroad, that they had been interesting years and had taught him much about the political problems and economics of post-war Europe. They had given him some understanding of the position the United States now holds in the world and of the tremendous part she must play in the future, and perhaps something also of her responsibilities. He said that permanent peace between nations cannot come out of force. Force leads only to more force. Peace can come only from the renunciation of force.

He stated that he was compelled by limited time to choose between saying a few words about each of the many issues which confront the country or speaking more fully about one of them and he took the latter alternative, bringing up the question as to whether we shall continue undisturbed a protectionist country or frankly abandon that well-tried and successful policy by turning to one of the many variations of a tariff for revenue only. He said he believed that while competition, broadly speaking, is wholly a desirable and necessary element in production, competition based on low standards of living can be and often is as destructive as an acid and should if possible not be permitted to affect our American life.

He said: "After all, we are not asked to decide for the first time whether protection either will or will not be a sound policy for the American people hereafter to follow. We have it now. It dates from the birth of the Republic itself. Under it our industries have grown and flourished to an unprecedented degree and upon it in varying degrees they are still dependent.

"Both parties have declared for a revision of the tariff. The question for us to decide is by which of them those adjustments shall be made. Are they to be made by those who believe in a protectionist policy or by those who do not believe in a protectionist policy?

"We have some experience to guide us. A tariff for revenue only has been tried before. The result is always the same. A few years of general depression and widespread unemployment and distress follow, and we turn back to the safe road."

BEGINNING OF FACTORY SYSTEM

The industrial revolution, so called, began in the England of Watts and Stephenson. There began the factory system of production—organized groups of workers using small power-driven machines under a common roof. Out of that initial use of power and machinery grew Britain's tremendous output of today. And yet, after more than a century of growth and development, the total power available for the individual worker in Britain ranges on the average about two horsepower.

He then referred to the extent to which machinery is now being used and stated that behind every factory worker today in the United States there stands a capital investment of $6,000 which puts at the disposal of that worker 4 1/3 horsepower. One horsepower is reckoned as the equivalent of ten men's power. In other words every worker, man or woman, on the average, engaged in manufacture is now enabled by machinery to do the work of 43 unaided men. He said that this was an astonishing fact the meaning of which could only be grasped by comparison. He pointed out that during the period under discussion, wages—real buying power—had increased on the average more than 50 per cent. On the other hand, hours of labor have decreased on the average more than 10 per cent. When the country, he said, turned again frankly and definitely to a protectionist policy our national income increased by leaps and bounds. It has been billions of dollars more than it was several years ago. In the average monthly number of freight cars loaded there was in 1927 an increase of a million over 1921. Building construction had increased 126 per cent during that period. Three million five hundred thousand new homes have been built. Life insurance has nearly doubled. Savings deposits increased from 15 billion in 1921 to 26 billion in 1927. We are using 14 million more automobiles and 6,000 more telephones and a million radio sets. Increased earning power has given the people means to obtain all these things. Shorter hours have given them more leisure time for recreation or other activities. Education has been greatly advanced.

EDUCATION GREATLY ADVANCED

Between 1921 and 1927 the number of children in our grade schools went up about 11 per cent, high schools 66 per cent, colleges and technical schools 75 per cent. Half the hospital accommodations in the whole world are in the United States. He referred to unemployment problems. He said that some way to meet that situation and not make it worse must be found. Then he said he believed in all sincerity that if our present steady advance continues uninterrupted and is not checked nor thwarted, "if we can go as far in the next few years as in the past few, we may be sure that we are approaching that goal—the elimination of poverty, of unemployment, of undernourishment, of fear, of cold, of ignorance.

Before closing the speaker also briefly discussed farm relief and other leading issues.

The Corning Glass Works of which Mr. Houghton is the chief executive, celebrated its 60th Anniversary this September. It is highly regarded throughout the glass industry as one of the few concerns "at the top"—one of the most progressive and successful in the industry and especially noted for its extensive research work, its development of numerous new and revolutionary manufacturing processes and new and successful products.

Decision Reached in Hartford-Empire vs. Obear-Nester Infringement Case

All Six Claims of Steimer Patent Valid and Infringed—Ten First Claims of Peiler Patent Found Invalid

The decision of the Court for the Eastern District of Missouri in the suit of the Hartford-Empire Company, of Hartford, Connecticut against the Obear-Nester Glass Company of St. Louis, Missouri for damages for alleged infringement of certain glass feeder patents controlled by the plaintiff, was given on October 6 by Federal Judge O. B. Faris who held that claims 1 to 6 of the Steimer patent under investigation by the court were valid and had been infringed, while claims 1 to 10 of the Peiler patent also involved were found to be invalid as being functional. Thirteen of the remaining Peiler claims were declared to be valid and infringed while 5 others were found not to be infringed.

Substantial abstracts from the decision are quoted below.

[NOTE—A supply of printed copies of the Court's decision complete has been obtained for the benefit of interested subscribers and copies will be mailed to those requesting one until the supply is exhausted.]

Abstracts

HARTFORD-EMPIRE COMPANY, PLAINTIFF, v. OBEAR-NESTER GLASS COMPANY, DEFENDANT. EQUITY NO. 7453, DISTRICT COURT FOR THE EASTERN DISTRICT OF MISSOURI.

Claims 1 to 6 of Steimer patent No. 1564909, for machines for manufacturing glass, were held to be valid and infringed. Claims 1-10 of Peiler patent No. 1573742 were found to be invalid as being functional; claims 15, 16, 18, 19, 21 to 23, 26 to 29, 33, and 36, were found to be valid and infringed, while claims 17, 20, 24, 25, and 34 were found not to be infringed.

* * *

Claims 1 to 10 of the Peiler patent were held to be invalid as covering merely the phase changing, the mere mechanical means of varying and governing the interval intervening between emergence of a section of glass and its severance by the shears. It was stated to be fundamental that the mere function cannot be patented in a mechanical patent; also, that other patents disclose the notion of phase changing.

Defendant's contention that the patents were invalid because of long delay in prosecution was not sustained, it being found that no facts upon which to impute the delay to the patentees were present, the applications having been delayed by interference proceedings in the Patent Office.

The contention that divisional applications filed over two years after the parent case is filed are invalid, by analogy to the two-year period provided for filing reissue applications, was not sustained, the Court stating the decisions do not indicate that a hard and fast rule exists whereby such delay in filing divisional cases creates an absolute bar to validity.

* * *

The answers set up the conventional defenses of denial of infringement and invalidity of the patents in suit, in view of the prior art pleaded, as also the invalidity of many, if not all, of the claims of both of the patents in suit, on account of the long delays concededly existing (a) between the date of filing the original applications and the issuance of the patents; (b) between the dates of filing the original applications and the first amendment; (c) between the dates of the several amendments, and (d) between the dates of filing of the original applications and the filing of divisional applications, particularly the divisional applications on whch the patents were finally granted.

The total period of these delays, from the date of the original application to the date of the issuance of the patent, was, in the Steimer patent, nearly 16 years, and in the Peiler patent over 13½ years, if, as plaintiff contends, the divisional applications and the amendments thereto constitute a continuing application and relate back to the date of the filing of the alleged parent application.

In the Peiler patent, in every case (except one not here deemed important, more than two years, as will be seen from the dates above set out, intervened between the original application and the first divisional application, and between these several divisional application intersese.

In the Steimer patent, the divisional application on which the patent issued was filed nearly 15 years after the filing of the original application.

* * *

I think it is clear, from the above shown statement of construction and operation of the accused device, when compared with the six claims of the Steimer patent, and claims 15, 16, 21, 18, 19, 22, 23, 26, 27, 28, 29, 33 and 36 of the Peiler patent in suit, that defendant's accused device reads on the above claims and infringes each and all of them, that is to say, of the six claims of the Steimer patent and of the above mentioned claims of the Peiler patent, provided such patents and the above claims are valid.

I conclude, for reasons I would as well now state, that claims 1 to 10, both inclusive, of the Peiler patent (the so-called method claims) are invalid, and so I need not consider whether or not they are infringed.

Claims 1 to 10, supra, are, as forecast, so-called method claims, and involve the notion of patenting the concept of "phase-changing," as plaintiff denominates it. I am not able to see that the phase-changing here contended for by plaintiff is anything more than a function. In short, it involves the problem to be solved, and not the mechanical method of solving such problem. It is fundamental, that a mere function ordinarily can not be patented in a mechanical patent.

* * *

I am also of the opinion that the claims of these patents in suit are not anticipated by the prior art patents in evidence. Those largely relied on by defendant, as anticipatory, are: Brookfield, No. 883779; Cleveland, No. 901881; Hitchcock, No. 805067 and No. 805068; Mansfield, No. 854511; Morrison, No. 810167; Proeger, No. 1059634; Schulze-Berge, No. 421620; Severin, No. 892013, and the French patent to Wilzin, No. 439150.

* * *

Steimer and Peiler made great improvements, which of themselves show invention. Devices made under their patents became almost at once popular, and have all but occupied the whole field. The fact of the grants and the great public acclaim, are to be considered as creating presumptions of validity, when validity is in doubt.

As to the validity of some of the claims of Peiler, I am in doubt, greatly in doubt, but I resolve these doubts in favor of such claims, by a consideration of the presumption of validity arising from the fact of grant, and from the fact of great commercial acclaim. The 10 long years of contests and interferences in the Patent Office would seem to create the inference that the claims of Peiler and Steimer were subjected there to the very greatest and most careful scrutiny.

I conclude that claims 1 to 6, both inclusive, of the Steimer patent in suit, are valid, and are infringed by the defendant's accused device; the claims 15, 16, 18, 19, 21, 22, 23, 26, 27, 28, 29, 33, and 36, of the Peiler patent are valid and infringed by defendant's accused device; that claims 1 to 10, both inclusive, of the Peiler patent are invalid, and the claims 17, 20, 24, 25, and 34, of the Peiler patent in suit are not infringed by defendant; hence, I do not pass on their validity. The other claims, not mentioned above, are not declared on in the bill of complaint; hence, they are not in issue.

* * *

Costs will follow the finding, and be taxed against defendant. A decree may be submitted in accordance with the above findings and conclusions, and judgment will be entered for plaintiff and against defendant.

October 6, 1928.

Rules of Conduct for Flat Glass Industry

Unfair Trade Practices Disapproved

An eleven-page statement containing data on the flat glass industry and covering the proceedings of the Trade Practice Conference held in Chicago on June 14, 1928, was issued on October 15 by the Federal Trade Commission at Washington.

The purpose of that meeting was to give all distributors and manufacturers in the industry an opportunity, either through a representative or in person, to formulate and discuss rules of business conduct for the industry on the subjects covered. More than 90 per cent of the flat glass jobbing and manufacturing interests was represented.

A. D. Dwelle, president of the National Glass Distributors' Association, thanked the Commission for the promptness with which the Conference was held and for assistance received in making preparations for this opportunity "to devise ways and means, under the guidance and advice of the Commission, to place the Flat Glass Industry on a fair business plane to correct questionable methods that have crept into the business which are obnoxious and are not based on sound business principles." Mr. Dwelle further stated, "Our earnest thought and purpose is solely to raise the merchandising standard of the Flat Glass Industry up and out of the slough of despair, depression and loss into which it has gradually, but surely, declined."

Resolutions presented at that meeting looking to improvement in the conduct of the industry were proposed, discussed and adopted: In the Commission's statement referred to above these have been rearranged in groups. Those shown under Group I have been affirmatively approved by the Commission. Those shown under Group II are accepted by it as expressions of the trade.

The rules became effective October 15, 1928.

GROUP I (APPROVED)

Inducing Breach of Contract

Rule 1. The willful interference by any person, firm, corporation or association, by any means or device whatsoever, with any existing contract or order between a seller and a purchaser, in or about the production, manufacture, transportation, purchase or sale of any product handled by the industry, or the performance of any contractual duty or service connected therewith, such interference being for the purpose or with the effect of dissipating, destroying or appropriating, in whole or in part, the patronage, property or business of another engaged in such industry, is an unfair trade practice.

Misbranding

Rule 2. The marking or branding of products of the industry for the purpose or with the effect of misleading or deceiving purchasers with respect to the quantity, quality, grade or substance of the goods purchased, is an unfair trade practice.

Fraud and Misrepresentation

Rule 3. The sale or offering for sale of any product of the industry with intent to deceive customers or prospective customers as to the quantity, quality, substance or size of such product, is an unfair trade practice.

Unbranded Products

Rule 4. The sale or shipment of window or sheet or other flat glass not branded or marked to indicate its true character, in accordance with accepted standards of the industry, is an unfair trade practice.

Substitution of Quality

Rule 5. As the shipment by manufacturers of window glass without labels on each light showing the quality of such glass makes possible the easy substitution of a lower quality of glass for a higher quality, particularly when such glass is removed for shipment or use from the original factory container, the industry hereby records its approval of the labeling by manufacturers in accordance with accepted standards of the industry, of each light of window glass, showing its thickness and quality, as a means of preventing unfair competition and deception of the purchasing public.

Secret Rebates

Rule 6. The payment or allowance of secret rebates, refunds, credits, or unearned discounts, whether in the form of money or otherwise, or the giving of premiums, or extending to certain purchasers special service or privileges not extended to all purchasers under like terms and conditions, is an unfair trade practice.

Price Discrimination

Rule 7. (formerly 8) Any discrimination in price between purchasers of the same class, not including discrimination in price on account of the difference in grade, quality or quantity of the product sold, or which makes only due allowance for difference in cost of selling and transportation, or discrimination in price in the same or different communities not made in good faith to meet competition, where the effect of such discrimination may be to substantially lessen competition or tend to create a monopoly, is an unfair trade practice: *Provided,* however, that nothing in this resolution shall be construed to prevent the publication and use of a special quantity price applicable to a definite quantity of goods which are placed in one order and, at the option of the shipper, are moved as one shipment.

Price Discrimination

Rule 8. (formerly 9) As the failure of the industry to adopt uniform practices with respect to requiring purchasers to pay transportation and trucking charges has inevitably resulted in unfair price discrimination, the allowance of transportation or trucking charges on products (a) sold f.o.b. seller's warehouse or city, or (b) sold on a delivered basis, transportation charges to be paid by the consignee, in *excess* of the actual or published amount of such charges, is an unfair trade practice: *Provided,* however, that nothing herein shall be construed to prevent the payment by the seller at his option of trucking charges within city limits.

Price Discrimination

Rule 9. (formerly 10) As packing, freight and trucking charges are necessarily reflected in price, and as the variable practice on the part of sellers of requiring purchasers in some instances to pay such charges and in other instances of assuming such charges causes unfair price discrimination, the failure of the seller to require the purchaser in each instance to pay published charges for packing, freight and trucking, is an unfair trade practice.

Price Discrimination

Rule 10. (formerly 11) As freight or transportation charges are reflected in the price, free trucking beyond city limits is an unfair method of competition, *unless* published with the price and allowed to all customers buying similar quantities within the same territory.

GROUP II

Inducing Sales of Other Products

Rule 11. (formerly 7) The industry hereby condemns as an unfair trade practice, the selling of glass without profit, for the purpose directly or indirectly, or with the effect, of furthering the sale of some other product.

Arbitration

Rule 12. The industry hereby records its approval of the practice of handling disputes in a fair and reasonable manner, coupled with a spirit of moderation and good will, and every effort should be made by the disputants themselves to arrive at an agreement. If unable to do so, arbitration under some one of the prevailing codes should be agreed upon, as it is at all times preferable to litigation with its costly handicaps and delays.

Selling without Specifications

Rule 13. The acceptance by distributors and manufacturers of blanket contracts from dealers or distributors of their product without statement of specifications affords opportunity for the rejection of such contracts by the purchasers on decline of price, provides an artificial stimulus to the industry through the existence of large numbers of unconfirmed contracts with resulting enhancement of prices to consumers, and constitutes an unfair trade practice: *Provided,* however, that nothing herein shall be construed to prevent the acceptance of contracts under the terms of which complete specifications will be furnished within ten days from date of acceptance of order, except in case of bona fide building contracts, then quantity and approximate sizes to be filed within ten days.

Pooled or Combination Cars

Rule 14. The expense of manufacturing, selling and transportation being appreciably more costly for small-quantity than for large-quantity lots, the industry hereby records its opposition to the sale of products to separate purchasers as full carload or other group lots, at a sales price which does not take into consideration the added expense involved in such method of sale.

Anti-Dumping

Rule 15. The practice of certain manufacturers and sellers of shipping quantities of merchandise into territories outside their particular territories, and of selling such merchandise below the general market prevailing in such other territories into which shipments are made, seriously tends to demoralize the market within the territories into which shipments are made, disrupts normal competitive conditions throughout the entire industry, and is condemned as an unfair trade practice.

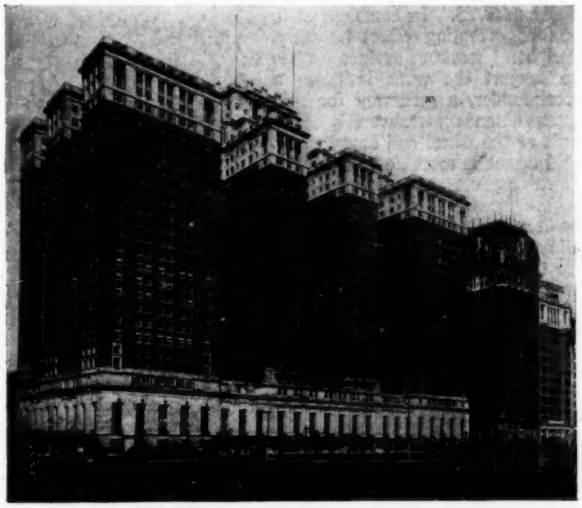
American Ceramic Exposition Only Three Months Away

Glass Manufacturers and Producers of Ceramic Wares Urged to Complete Their Exhibition Plans Promptly. Makers of Equipment and Factory Supplies Also Will Exhibit

Determined efforts are being made by the American Ceramic Society to make the Annual Meeting and The American Ceramic Exposition, which as announced in the September issue, will be held in conjunction therewith at Chicago from February 4 to 9, 1929, the most successful meeting in the Society's history.

The Exposition will be held in the spacious Exhibition Hall, Stevents Hotel, said to be the world's largest hotel, which also will be headquarters for the Society and the place where its meetings will be held.

The Chicago Branch naturally is particularly active and enthusiastic. The Industrial Section as reported several weeks ago from the Chicago Section headquarters already showed prospects of being an overwhelming success, and possibilities of a space overflow into the products exposition section were seen.



HOTEL STEVENS, CONVENTION HEADQUARTERS

W. H. Boshart, president of the Owens Bottle Company, Toledo, O., and W. L. Orme, vice president of the Cambridge Glass Company, Cambridge, O., are serving on the executive committee.

Three other associations will meet at the same time—The National Brick, Common Brick, and Hollow Building Tile associations. This means that several thousand delegates and other interested visitors will be present. In addition to these, there will be buyers, department store managers and agents present. Exposition will be open to the buying public at certain hours each day. It will open at 12 noon Monday, February 4, 1929, and at 12 noon daily thereafter, up to and including Saturday, February 9, 1929, and will close each evening at 10 P. M.

The exhibits will consist of all types of manufactured ceramic products made of glass, enamel, pottery, clay, etc.

The convention program will be so arranged that part of each day will be devoted to inspection of exhibits. All convention meetings will be held within the Stevens Hotel in close proximity to the Exhibition Hall.

Up to October 6 a large number of commitments from factory equipment and supply concerns had been received. Full particulars regarding allotment of exhibition space, a diagram of the floor plan, rental costs, electric current, compressed air, etc. and directions for shipment of exhibit materials by express, freight and otherwise may be obtained from D. F. Albery, Chairman of the Chicago Section of the Society, 37 Van Buren Street, Chicago.

The week of February 4-9 inclusive, 1929, will be nationally known as American Ceramic Week. Special invitations will be sent to buyers of ceramic products throughout the United States. All of the principal retail stores in the Chicago district will have extensive ceramic displays in their show windows during the week of the exposition. Publicity featuring the exposition will be national and carried in newspapers and trade publications.

The purpose of the American Ceramic Exposition is to create a better appreciation of the value, permanence, attractiveness, and usefulness of American ceramic products, thus increasing their use and benefiting everyone connected with the industry and indirectly the whole nation. And, moreover, the exposition will be a testimonial to the American Ceramic Society through whose agency valuable contributions to the science and technology of ceramics have been made.

Working on Glass Division Program

The scientific and technical objects of the Society will not be underemphasized. General and Division meetings will be held as usual. Division officers and program committees have been busy for many weeks discussing the best plans and arrangements for the meetings and look forward to obtaining a full program of interesting and valuable papers. For the Glass Division a number have already been prepared or promised.

New Publications

Trade Associations: The Legal Aspects. By Benjamin S. Kirsh, formerly special assistant to the United States Attorney of New York in the prosecution of Sherman Anti-Trust Act cases, and member of the New York Bar. Published by Central Book Company, 99 Nassau Street, New York. Price $5.00. A comprehensive analysis and discussion of the legal aspects of trade association activities. Deals with the constructive and positive—as well as the negative and prohibited—features of trade association activity. Indicates limits and boundaries of permissible and prohibited trade association policies and practices. A practical, as well as analytical, survey of trade associations and the law.

Celite for Concrete. Celite Products Company, Los Angeles, Cal. Bulletin 339. Describes fully how Celite functions to improve workability in a concrete mix and how the improvement of workability affects the uniformity, water-tightness, and appearance of the finished concrete. A discussion of water-cement ratio control and the application of Celite when water-cement ratio control is employed, is also included. A special circular just issued, "Quality Concrete in *Every* Type of Structure," shows the adaptability of this material to all classes of construction work, including warehouses, factories, etc.

Welded Indicating Flow Meters. The Meriam Company, Cleveland, O., have placed on the market a new welded type of indicating flow meter suitable for measuring the flow of air, gas, saturated or superheated steam, oils and other liquids of any temperature, vacuum, or pressure. In this meter all pipe lines, valves, etc., in the connections are welded, the use of threaded unions having been discarded. The new atomic hydrogen welding method is used.

Catalog No. 93. The Brown Instrument Company, Philadelphia, Pa., describes the applications and types of Brown Resistance Thermometers, as applied to modern industries for measuring temperatures from —300° to + 1,000° F., for indicating, recording and controlling temperatures. This is a 58-page catalog liberally illustrated with photographs of installations and of the separate instruments and their parts.

New Lange Economy Rougher. A four-page folder devoted to the new machine developed by H. G. Lange Machine Works, 66 North May street, Chicago. This is a self-contained horizontal, glass grinding or roughing mill with cast iron plate for use with abrasive grains for rough grinding bevels, straightening and grinding chipped edges of glass, etc.

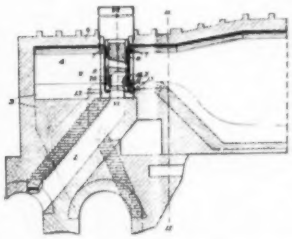
Resistance Thermometers. Leeds & Northrup Company, Philadelphia, Pa. A twenty-eight page catalog No. 80 describing temperature control, recording, and indicating instruments and giving list prices on various types of equipment.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

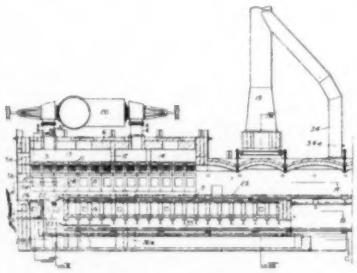
Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

REVERSING FURNACE AND METHOD OF OPERATING THE SAME. U. S. 1,687,710. Oct. 16, 1928. Walter De Fries, Wilkinsburg, Pa., assignor to Blaw-Knox Company. Filed 12/1/20. The method of operating reversing furnaces, which comprises placing a mixing device in the path of the incoming elements of combustion to break up the same into a series of small streams, preheating at least one of the elements of the combustion mixture, increasing the velocity of said streams, bringing said high velocity streams into contact with each other within the furnace, removing the mixing devices, and reversing the furnace.



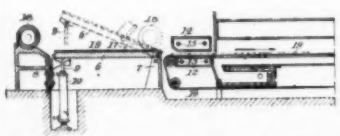
GLASS-GRINDING MACHINE. U. S. 1,687,985. Oct. 16, 1928. Stephen P. Mermer, Toledo, O. Filed 2/26/27. A machine for grinding edges of glass plates comprising a line of support upon which the glass may be stood on edge in substantially vertical position, means for guidingly maintaining said plate in such position, grinding means rotated substantially on the level with said line of support and onto which the glass plate moves so that the edge thereof may be ground, and means for turning the glass in order that another edge thereof may be ground.

GLASS LEHR. U. S. 1,684,239. Sept. 11, 1928. William A. Morton, Pittsburgh, Pa., assignor to the Amsler-Morton Company. Filed 3/14/25. In a glass lehr of the muffle type having an endless conveyor for carrying wares therethrough, and in which the muffle overhangs the forward end of the conveyor, said lehr having passages for the circulation of gases around the sides and under the bottom of the muffle, other passages at the sides of the forward end of the muffle for heating the portion of the muffle overhanging and in advance of the conveyor, and a surface over and in close proximity to which the forward end of the return portion of the conveyor moves, and a circulating passage under said surface through which gases passing through the said passages at the forward end of the muffle flow to heat the conveyor.

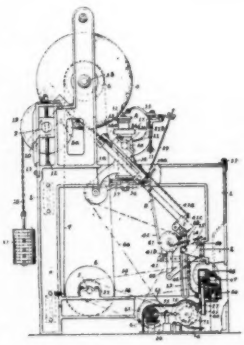


SHEET-GLASS-EDGE-FORMING MEANS. U. S. 1,684,440. Sept. 18, 1928. Frank Fraser, Toledo, O., assignor to Libbey-Owens Sheet Glass Company. Filed 6/5/25. Renewed 9/26/27. To provide means in sheet glass drawing apparatus capable of holding the sheet to width, at least as satisfactorily as the knurled rolls now used, and which will also hold the sheet to width without creating such a large useless portion.

METHOD OF APPARATUS FOR FORMING PLATE GLASS. U. S. 1,684,030. Sept. 11, 1928. George E. Howard, Butler, Pa., assignor to Hartford-Empire Company. Filed 12/27/26. A means whereby intermittently rolled sheets may be introduced into the lehr in such manner that all parts of each plate, as it enters the lehr, will be in substantially the same condition as to temperature and as to tension between the particles. At the entrance to the lehr, an apron is provided which is hollow, and is provided with openings in its sides through which a heating or cooling medium may be introduced to control the temperature of the glass previous to its entry into the lehr. Above the apron is provided a casing that has openings through which a heating or cooling medium may be introduced. A conveyor belt is driven in any suitable manner and serves to advance the plates of glass into and through the lehr.



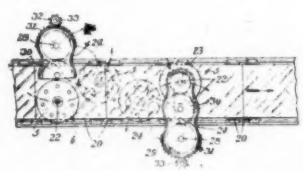
GLASS-BEVELING MACHINE. U. S. 1,688,068. Oct. 16, 1928. Bertrand E. Beyer, Paterson, N. J., assignor to American Bevel Glass Company. Filed 8/19/25. In combination, a rotated operating wheel having a peripheral working surface, means to support the work including a work-holder, a guideway for said means extending transversely of the axis of the wheel and along which said means is movable to bring the work against said surface and with reference to which the work-holder is adjustable to different inclinations, and supporting means for the guideway adjustable to support the same in different planes angularly related to each other and coinciding with chords of a circle whose center coincides with said axis.



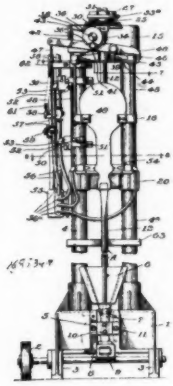
OPTICAL GLASS. U. S. 1,681,704. August 21, 1928. Robert J. Montgomery, Rochester, N. Y., assignor to Bausch & Lomb Optical Co. Filed 4/16/23. A glass mix or batch containing the following materials in substantially the proportions stated:

	Per centum.
Silica	69.5
Sodium oxide	15.8
Boric oxide	.3
Commercial didymium oxide	12.0
Antimony oxide	1.9
Arsenic oxide	.5

METHOD AND APPARATUS FOR POLISHING GLASS. U. S. 1,684,029. Sept. 11, 1928. George E. Howard, Butler, Pa., assignor to Hartford-Empire Company. Filed 12/11/26. A means whereby a substantially uniform polishing operation may be performed upon a longitudinally moving sheet of glass in all of the longitudinal zones thereof. The combination with means for imparting traveling movement to a sheet of glass, of polishing apparatus, comprising a head, means for rotating said head, a series of freely rotatable polishing pads on said head disposed circumferentially of the axis thereof, and a cam for reciprocating said head transversely of the path of the glass, the cam being of such size that the head will be moved a distance not materially less than one-half of its diameter.



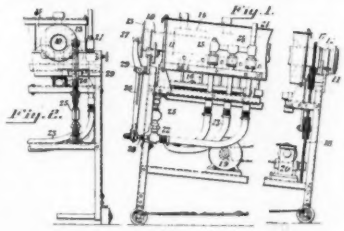
ELECTRIC-LAMP BULB. U. S. 1,687,510. Oct. 16, 1928. Marvin Pipkin, Cleveland Heights, O., assignor to General Electric Company. Filed 6/29/25. A glass electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb, said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices to such an extent that the strength to resist breakage by impact is greater than twenty per cent of that of the clear bulb.



TEMPERATURE-CONTROLLING MEANS. U. S. 1,685,348. Sept. 25, 1928. James Bailey, Corning, N. Y., assignor to Corning Glass Works. Filed 6/11/23. Novel means for utilizing expansion and contraction of a heated cylindrical chamber for the purpose of actuating a valve controlling the heating medium so that when the chamber has been heated to the desired temperature the supply of heat will be reduced, and when the temperature has fallen below that desired the valve will be opened to increase the amount of heat in the chamber. The inventor claims the combination with a rotating chamber to receive the articles, of means for heating the chamber, a controller for regulating the heat so imparted, and means for actuating the controller comprising a member having rolling contact with the end of the chamber and adapted to be shifted by the expansion thereof.

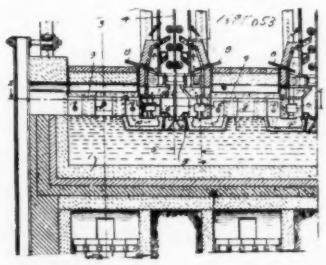
SHEET-DRAWING APPARATUS. U. S. 1,684,437. Sept. 18, 1928. Enoch T. Ferngren, Toledo, O., assignor to Libbey-Owens Sheet Glass Company. Filed 12/23/24. In sheet glass apparatus, means to draw a sheet of glass from a source of molten glass, including a sheet supplying meniscus, and heat absorbing means positioned on both sides of the sheet and having a curved end whereby the said means can be placed relatively close to the sheet without interference to the sheet supplying meniscus, the lower extremity of the heat absorbing means being a substantial distance from the base of the said sheet supplying meniscus.

APPARATUS FOR AND PROCESS OF FINISHING BLOWN-GLASS ARTICLES. U. S. 1,685,349. Sept. 25, 1928. James Bailey, Corning, N. Y., assignor to Corning Glass Works. Filed 11/26/23. Renewed 7/2/28. A complete finishing machine for articles which are attached to the end of a blow-pipe during fabrication. The primary object is to cut the article from the blow-pipe and to finally finish and anneal it. The present invention has for its object to use the weight of the blow-pipe and the moil attached thereto, to accelerate the severing of the glass articles from the blow-pipe, by reducing the time of severing the article from the blow-pipe, greatly reducing the heating medium used, without in any way requiring a heavy moil or end.



A further object of the invention is to use the weight of the blow-pipe to draw out and thus thin the wall of the article, in the zone where severance is desired, while it is being finished in the machine.

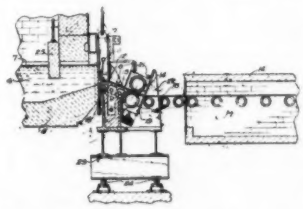
GLASS FURNACE. U. S. 1,685,053. Sept. 18, 1928. Thomas B. Hart, Libow, W. Va., assignor of one-half to Adamston Flat Glass Company. Filed 6/5/26. For sheet glass drawing machines. One object is the provision of a plurality of floating heating chambers adapted to receive heat therein directly from the central heating chambers, said floating chambers being so positioned with respect to the "debiteuse" as to prevent pockets or the like being formed between said debiteuse and floating chambers.



A further object is so constructing the apparatus that the current of heated air will be generated from the central heating chambers through the floating heating chambers from whence the same are conducted the suspended arches to annealing chambers in connection with the drawing machines, and in the construction of improved annealing chambers arranged in triple-deck fashion, with control dampers respectively in connection therewith so that one or more sets of annealing chambers may be used, as may be desired.

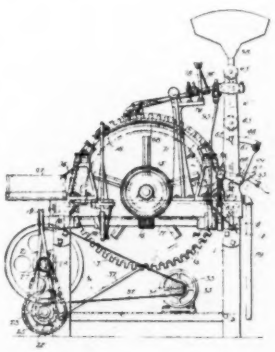
Also, in so constructing the furnace as to provide an independent checker chamber for each heating chamber used in connection with the drawing well; also in constructing the upper portion of the side walls of the tank of collapsible sections spaced apart, the spaces being covered by interfitting, removable loose-leaf sections through which the combustible fuel is introduced to the furnace.

SHEET-GLASS APPARATUS. U. S. 1,680,241. Aug. 7, 1928. James C. Blair of Toledo, O., assignor to The Libbey-Owens Sheet Glass Company. Filed 6/24/26. In sheet glass apparatus, a receptacle containing a mass of molten glass, a slab associated with said receptacle for receiving the molten glass therefrom, an adjustable gate for controlling the amount of glass flowing onto the slab, means for internally heating said gate, means for reducing the glass to a substantially predetermined thickness as it leaves the slab, and means for adjusting the slab.



LEHR CONSTRUCTION. U. S. 1,683,973. Sept. 11, 1928. Herman S. Heichert, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. Filed 7/29/26. The combination with apparatus for intermittently rolling sheets of glass, of a roller lehr comprising a high speed section which receives the sheets from the rolling apparatus, and a slow speed section following the high speed section, means for driving the rolls of the slow speed section at a relatively low rate of peripheral speed, means for driving the rolls of the high speed section either at a rate of speed corresponding to that of the rolls in the slow speed section or at a much higher rate of speed, means for shifting the rolls of the high speed section from the low speed to the higher one, and automatic means for shifting said rolls back to the slower speed again before the sheet has passed off of said rolls onto the rolls of the slow speed section.

MACHINE FOR FORMING GLASS VIALS. U. S. 1,688,190. Oct. 16, 1928. Robert H. Koenig, Haddon Heights, N. J., assignor to Ruth Glass Company. Filed 6/4/26. In a machine of the character described, the combination with a continuously advancing conveyer for tubular glass blanks comprising a series of parallel disks having substantially aligned peripheral recesses adapted to receive said blanks, a burner located adjacent the path of the blanks when advanced by said disks and adapted to heat the blanks intermediate their ends, and means for drawing the blanks apart at the heated section including movable elements adapted to engage the tops of the blanks as they are advanced to said conveyer.



METHOD OF MAKING CORRUGATED WIRE GLASS. U. S. 1,676,773. July 10, 1928. Walter Cox and Arno Shuman, Philadelphia, Pa., assignor to Pennsylvania Wire Glass Co. Filed 7/16/27.

Correcting Loss of Transparency in Ultra Violet Glass

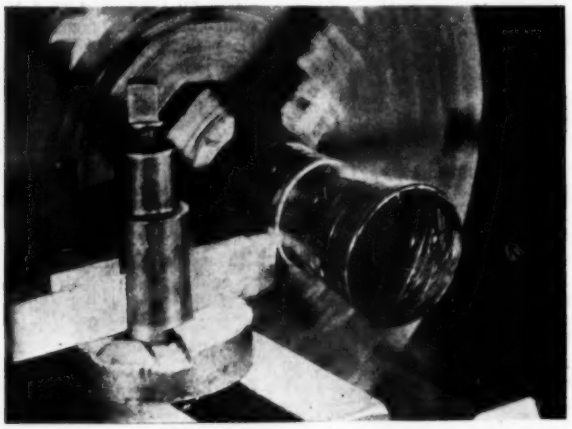
GLASS MANUFACTURE. British Patent 291,468. Soc. Anon. Des Manufactures Des Glaces et Produits Chimiques De Saint-Gobain, Chauny, Et Cirey, Paris, France. June 2, 1928. Convention date June 4, 1927. No. 16178. Not yet accepted. Relates to glass which has a considerable degree of transparency to ultra-violet rays, and to the tendency of the glass to lose a considerable part of its transparency. In order to correct this tendency, a small proportion of oxide of manganese is incorporated with the glass. Silica glass and transparent cast silica may be treated similarly.

Glass Factory Equipment and Supplies

Most of the information printed in this department comes direct from the manufacturers of the products described.

General Electric Develops New Tool Material

Cutting a screw thread in a glass rod, boring a smooth hole in a block of concrete, handling porcelain on a lathe, and cutting the hardest of steels—things difficult or even impossible with present-day machine tools—are among the things that can be done easily with a new kind of machine tool material announced by Dr. S. L. Hoyt of the research laboratory of the General Electric Company at the annual convention of the American Society for Steel Treating, at Philadelphia, October 11. The new material,



CUTTING GLASS ON A LATHE WITH CARBOLOY—START OF THE CUT

named carboloy, is composed of tungsten carbide and cobalt, the carbide being extremely hard and the cobalt giving it the necessary strength for cutting tools.

Usual cutting tools will not affect a glass rod; instead, a rod of glass in a lathe will wear off the edge of a cutting tool that is pressed against it. The tungsten carbide tool quickly cuts into

WIDE AND DEEP GROOVE IN GLASS, CUT WITH CARBOLOY

the glass, and can even be used for cutting a screw thread into the rod. Likewise, hard porcelain insulators can be machined on a shaper with the new material.

Hardness is the notable physical property of carboloy. It scratches glass just as a diamond does. The Rockwell tests showed that a common hardened tool steel has a maximum hardness of 850 on the Brinell scale, that the hardest steel may be taken as about 1,000, and that the hardness of carboloy runs 2,000 and above. The tungsten carbide material does not pit or tarnish and is dissolved in acids only with great difficulty. It retains its strength and hardness at elevated temperatures to a remarkable degree. The addition of cobalt to the tungsten carbide is the cause of its increase in strength. German investigators have been pretty active and there are foreign and domestic patents for tungsten-carbon-cobalt alloys such as the "Hartmetall" of the Osram Lamp Company and similar alloys of the Krupp Company. It is stated that the General Electric Company has improved the hardness and other physical properties of the material.

Simplified Drive for Industrial Batch Cars

Stephens-Adamson Manufacturing Company, Aurora, Ill., builders of material conveying and handling equipment, have found that one method of cutting engineering and production costs of batch mixers is to standardize on one method of drive. Three sizes have been developed which can be used to drive practically any car.

The ordinary scale car consists primarily of a collecting hopper mounted upon a scale, enabling the operator to add a

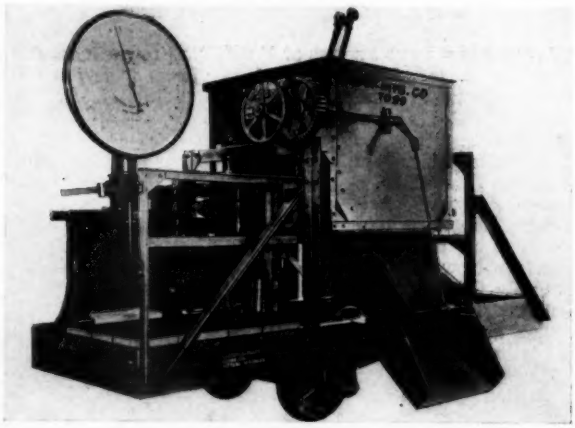


FIG. 1—BATCH COLLECTING AND WEIGHING CAR

definite amount of each ingredient to the hopper. Several forms of scales are in use, the simple single-beam scale which is satisfactory where but one or two materials are compounded. Where the mixture is more complicated multiple beam scales are used.

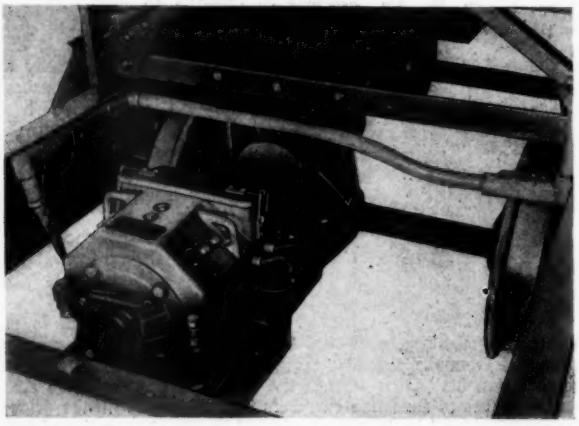


FIG. 2—DETAILS OF STANDARDIZED DRIVE

These are furnished with a beam for each ingredient and each beam can be set for the weight desired.

The operator merely has to add enough of each material to balance the proper beam. When desired as a safeguard, a recording device can be used to print the weights of the various ingredients used.

The car illustrated above (Fig. 1), was built to collect batch in a glass plant. It has a capacity of 40 cu. ft., is equipped with a 5,000 lb. dial scale and is driven by a 6½ H.P. mill type motor equipped with Timken bearings, easy and smooth running.

Fig. 2 shows a detail of this standardized drive which it is claimed requires but two bolts to mount, has three point suspension, two points of which are furnished by the drive axle, and makes possible a lighter and a simpler car. The track clearance is increased by several inches. Both motor and worm shafts turn in Timken tapered roller bearings to insure positive alignment and low power loss. The drive is simple, totally enclosed, well lubricated, quiet, and stated to be safe and durable.

The Glass World and What It Is Doing

News of the Industry

Annual Report of American Window Glass Company

The report for the year ending August 31, 1928, of President Wm. L. Monro of the American Window Glass Company to the company's stockholders was presented at their annual meeting on October 16. The report showed a net loss of $2,322,241 after deductions for depreciation, payment of royalties, etc. The net loss was considerably larger than for the year ending October 1927 when it amounted to $381,350. After deducting dividends on capital stock totaling $279,650, the surplus remaining was $7,582,546 as compared with $10,184,437 at the end of the previous year. Sales during the past year amounted to 326,500 more boxes than during the previous year, but prices received were much lower owing to general reductions in the price of window glass, foreign competition, etc. The recent advance in prices of 10 per cent in May and 9 per cent in July however is firmly established and a decided improvement in market conditions is anticipated.

Part of the company's output is now being successfully produced by their Fourcault installation at the Bellevernon plant.

Important improvements have been decided upon, including the installation of twelve Fourcault type machines at Arnold, Pa., that will draw sheets larger than any heretofore made by this process in this country. The installation at the Arnold factory of a continuous grinding and polishing plant for heavy glass is also under consideration, and Mr. Monro stated that he felt confident that the results so far obtained would justify the company in installing there such a plant, using a process for which the company purchased a license some years ago. Mr. Monro announced also that the company will soon produce laminated glass on a new type of machine, experiments having been conducted at the Jeannette factory and commercial production being in sight in the near future. The market for Quartz-Lite glass was reported by the president to be somewhat disappointing and this he attributed to the fact that much misleading information had been published regarding the health-giving rays of ultraviolet glasses which had raised doubts in the minds of prospective buyers. The company has decided on a national advertising campaign to increase the popularity of its glass and the knowledge of the public concerning its quality.

New members elected to the board of directors include James D. Rhodes of Pittsburgh, and J. A. Haberkorn of Chicago. Directors re-elected are Arthur E. Braun, James D. Callery, Thomas F. Hart, George C. Moore, George M. McCandless, H. N. Van Voorhis and William L. Monro. The company officers were re-elected for another year.

Adamston Flat Glass Company to Expand

It was announced shortly before the middle of October that the Libbey-Owens Sheet Glass Company had acquired a substantial stock interest in the Adamston Flat Glass Company, Clarksburg, W. Va. This is one of the few Fourcault machine plants which has been operated in this country successfully from the financial point of view, and it will continue to be operated under the present management which has been in charge during the period of development. Coincidently with the announcement of Libbey-Owens new interest in this plant another statement was issued by the Adamston administration to the effect that for the purpose of installing another unit for making heavy glass exclusively, additional capital as well as additional working capital was required so that an interest in the business has been sold to Weber & Company, of New York. The fact is made quite clear that the expansion relates to heavy glass only and there is no reason for the window glass market to feel disturbed.

Weber & Company of New York have acquired through the Farmers Loan & Trust Company, New York, a substantial interest in the Company and, the statement says, will have charge of its financial program.

The Company was organized in May, 1926, and has been successful from the start. It is expected that with the substantial financial interests behind the company, it will show greater growth in the future.

There is no change contemplated in the management or policy of the company, the directors of which are as follows: H. B. Curtin, W. B. Gribble, J. M. Carskadon, J. A. McNichol, J. L. Nelson, W. M. B. Sine.

The officers are: H. B. Curtin, president, J. A. McNichol, vice president, W. B. Gribble, vice president, W. M. B. Sine, secretary-treasurer and general manager.

Briefs Filed in Window Glass Tariff Investigation

Briefs in the case of the application by window glass manufacturers for an increase in the tariff on that product and concerning which a hearing was held by the Tariff Commission at Washington beginning September 11 were filed as required by the Commission during October by James B. Reynolds, attorney for the Window Glass Manufacturers Association and by representatives of the Belgian manufacturers. The manufacturers' brief pointed out that the data collected by the Commission's investigators was very reliable and that they were willing to rest their case on the figures compiled in the Preliminary Statement of Information. The investigators' figures showed that the cost of production of window glass in the United States is practically twice that of the manufacturers in Belgium, the United States cost being $.0424 and that of Belgium $.0205 or $.0229 according to the method used for converting Belgian francs into American money. This, the brief said, is one of the facts that prove the necessity for an increase in duties on window glass. The brief answers the Belgian arguments brought out at the hearing on Czechoslovakian costs, depreciations, imputed interests, royalties, bonuses, export tax, custom expense, extra cutting costs, and labeling. The brief also discusses the Commissions list of seven questions printed in the Preliminary Statement on which discussion was requested at the time the Statement was issued.

The brief submitted for the foreign manufacturers by John R. Rafter reiterated many of the arguments they had previously made. Both briefs are under consideration by the Tariff Commission and up to the time of going to press no statement as to the Commission's probable action in the case had been given out.

Secretary Sorden Leaves Mirror Manufacturers

Harry C. Sorden, on October 9, informed the mirror trade that he had accepted a position as sales manager for the La France Textile Industries and that his whole time would be occupied in that field so that it had become necessary for him to tender his resignation as secretary of the National Association of Mirror Manufacturers, effective December 15.

Mr. Sorden called attention to the annual meeting of mirror manufacturers at Pittsburgh on December 4 and 5 and hopes that there will be the largest attendance at that meeting in the history of the industry.

Roessler & Hasslacher Long Service Awards

The Roessler & Hasslacher Chemical Company, New York, on Wednesday evening, October 24, in recognition of faithful service, gave well merited tribute to fifteen employees who had been with the company for over twenty-five years. The occasion was the annual banquet of the Parah Club, a social club organized by the members of the company, held at the Masonic Temple, Perth Amboy, N. J., where the R. & H. manufacturing plants are located. A delegation representing more than half of the New York office force was transported in buses to Perth Amboy with motorcycle police escort. A thrilling ride through crowded sections prepared the guests for an entertaining evening.

The Masonic Temple Hall had been beautifully decorated. A humorous menu suggested the courses. Addresses by executives and the entertainment led up to the high point of the evening, the presentation of awards in the form of gold watches. On the honor roll were:

Fritz Hoyler, 38 years	James P. Cleary, 27 years
Nels Mikkelson, 34 years	Lawrence MacLeod, 27 years
Thomas Martenson, 33 years	Frank Meyer, 26 years
George Woitscheck, 32 years	James McKeown, 26 years
George Gardner, 31 years	Joseph Urffer, 26 years
Charles Baumlin, 31 years	Fred Steinmetz, 25 years
J. Emil Kaus, 29 years	Michael Ebner, 25 years

C. M. Will, 25 years.

After the presentation of the awards an inspiring talk was given by Dr. Samuel Steinmetz.

Canadian Safety Glass Manufacturing Plant

W. E. Phillips Company, Limited, Oshawa, Ont., W. E. Phillips, president, are building a warehouse in Regina, Saskatchewan, to take care of their local western glass jobbing trade. It will have complete equipment for beveling and silvering. The Weber automobile type edge machine is being used. This equipment is connected with the General Motors' assembly plant which has been established in Regina. Newspaper reports to the effect that Regina was to have a new glass factory are incorrect.

The W. E. Phillips Company are also interested in their subsidiary the Duplate Safety Glass Company of Canada recently organized and affiliated with the Pittsburgh Safety Glass Company which is controlled by the Pittsburgh Plate Glass Company and the Dupont Company. A factory for the production of Canadian made Duplate is near completion at Oshawa, and will be ready for operation, it is expected within the next two months.

September Construction Broke Records

September construction contracts in the territory east of the Rocky Mountains reached a total of $587,674,000, according to the F. W. Dodge Corporation. The area covered in this record consists of 37 States and includes approximately 91 per cent of the total construction in the United States. The total of contracts awarded was the highest September contract total on record. It was 13 per cent ahead of the total for the same month of last year and 14 per cent ahead of August, 1928.

Mirror Manufacturers Report

Harry C. Sorden, secretary of the National Association of Mirror Manufacturers has issued the "Trade Barometer" report No. 9 dated October 20, 1928, showing that 18 manufacturers report having silvered the following quantities of glass.

September, 1928	202,778 feet
August, 1928	288,732 feet
September, 1927	335,236 feet

The reports show that business generally in this line is very good.

Inventor Honored

Auer von Welsbach, the inventor of the incandescent lamp and the discoverer of the rare elements praseodymium and neodymium celebrated his seventieth birthday on September 1st, at which occasion he received from the German Auer Society two beautiful crystal vases. One of these was colored with praseodymium, the other with neodymium. The vases are the first objects colored by these rare earths, and are of astonishing beauty and coloration.

Fostoria Glass Stock and Cash Dividend

The directors of the Fostoria Glass Company, Moundsville, W. Va., on October 1, declared a 50% stock dividend as well as the regular quarterly 5% cash dividend payable to stockholders November 1. For each two shares held by stockholders they will receive one additional share of the new stock which results from the increase in capital stock from $1,000,000 to $3,000,000 recently decided upon in order to take care of the company's rapidly expanding business.

Heavy Increase in the Duty on Fluorspar

President Coolidge, exercising the authority vested in him by the Tariff Act of 1922 has issued a proclamation increasing the rate of duty on imports of fluorspar containing not more than 93% calcium fluoride, from $5.60 to $8.40 per long ton. The Tariff Commission had recommended this increase to equalize the difference in the cost of production of fluorspar in the United States and its principal competitor, England.

Polished Plate Glass Production

From figures compiled by P. A. Hughes, secretary of the Plate Glass Manufacturers of America, the production of polished plate glass for the month of September, 1928, was 10,247,620 square feet, which makes the total for the third quarter, 31,067,386 square feet, and brings the production for the first nine months of 1928 to 91,562,954 square feet.

President Has Report on Plate Glass Investigation

The report on the inquiry by the United States Tariff Commission into the relative costs of production of Belgium and domestic-made plate glass has been submitted to President Coolidge who has not yet acted upon its findings.

Trade Activities

The Imperial Glass Company, Bellaire, O., has recently made a number of changes in its staff and has a new factory manager, Edward Hill of Lancaster, O., who has succeeded Charles Morris. The latter resigned and it is reported will spend the winter in Florida. Bert Muhleman is said to have also resigned as a member of the board of directors. He had been connected with the Imperial Glass Works since it started in business in 1904. His uncle, Captain Edward Muhleman was president of the company when it was first organized. Another resignation reported was that of Albert VanDyne, foreman of the decorating department. The new manager Edward Hill took up his duties at the beginning of October.

The Highland-Western Glass Company is the new name under which the Highland Glass Company and the Western Glass Company have merged their businesses, bringing under one control factories at Washington, Pa., Streator, Ill., Fullerton, Cal. Another plant at Shirley, Ind. is taken in but is not being operated at present. In these factories all kinds of rolled glass, rough and ribbed, wire and polished wire glass and fancy figured glass are made.

The Paramount Glass Company, whose factory at Star City, W. Va., was recently destroyed by fire have accepted a proposition to locate at St. Marys, W. Va., where the "upper glass plant" has been acquired, in which they will resume operations early in November. The company had been operating steadily for seven or eight years at Star City and averaged from 40 to 75 employees, many of whom it is believed will move to St. Marys.

The Standard Plate Glass Company discontinued operations in their casting hall grinding and polishing departments at Springdale, Pa., on September 25 for an indefinite period for the reason, it is stated, that the equipment has become obsolete and cannot be operated profitably. Approximately 300 workmen are said to have been affected, some of whom have been transferred to the Company's plant at Butler, Pa.

The Clearview Glass Company is reported to have acquired 37 acres of land and the old power house of the Short Line Traction Company, near Butler, Pa., to make plate glass. C. H. Christie of Butler is president and Frank E. Troutman, formerly general manager of the Standard Plate Glass Company is said to be interested.

The Pittsburgh Plate Glass Company in October declared a stock dividend of 10% payable December 1, and put into effect the split-up of old stock on the four-for-one basis previously approved by the stockholders who had authorized an increase in the capital stock from $50,000,000 to $65,000,000, converting each share of $100 par value into four shares of $25 par value.

Dr. Fritz Eckert, head of the glass technology department of the Technical High School, Berlin, Germany, who arrived in New York early in October, sailed for home October 26.

Steve Coleman, Jr. recently resigned as chemical engineer and chief chemist for the Three Rivers Glass Company, Three Rivers, Texas.

Coming Meetings

The Pittsburgh Section, of the American Ceramic Society, will meet Tuesday evening, November 13, at the Fellows Room of the Mellon Institute. Spotts McDowell will speak on 'Technological Developments on the Manufacture of Refractories."

The American Bottlers of Carbonated Beverages will hold their annual convention and exposition November 12-16 in the Detroit (Mich.) Convention Hall.

National Association of Mirror Manufacturers will hold its annual meeting at Pittsburgh, December 4 and 5.

Recent Deaths

James T. Riley

James T. Riley, one of the founders of the American Plate Glass Company at Kane, Pa., died at his home in Brooklyn, N. Y., on October 1. He became connected with the company when it was organized in January, 1906, and was secretary and assistant treasurer for eight years.

William Turner

William Turner, brother of John Turner, director of the Hires-Turner Glass Company who retired from active association wtih the company a few months ago on reaching his fiftieth anniversary, died at his home at Wyncote, Pa., on October 16, at the age of seventy-two years.

John A. Sweet

John A. Sweet who had been superintendent of the Pittsburgh Plate Glass Company's works at Ellwood, Pa., for a short time, died suddenly on September 31 at Pittsburgh, where he contracted an illness while in that city on business.

What The World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

Austria—33713, optical lenses.

Canada—33711, milk bottles for dairy use.

Argentina—33738, baby bottles.

England—33631, cut, blown, molded, stem ware glass for electric, gas, and oil lighting uses.

Peru—33619, glassware and pottery.

Inquiries Received

For further information address THE GLASS INDUSTRY

438 Where can I obtain a "four-in-one" bottle, quart size with half-pint compartments? I have seen two different kinds of these bottles in pressed ware and can use 1,000 of them to start with.

439. (From Sweden.) We need a new belt to our lehr. Please give us addresses of some of your advertisers manufacturing spiral woven wire belts.

440. Who manufactures sheet plate glass, known as "non-breakable" or "non-shatterable" glass as used for bank tellers' windows, armored cars' windshields, etc.

441. We are desirous of obtaining different types of bottles for insecticides and shampoos.

442. Who makes the oil burner used in "fireless" lehrs?

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, OCTOBER 23, 1928

Reported by Moore Leonard & Lynch, Union Bank Bldg., Pittsburgh, Pa.

	Bid	Asked	Last
American Window Glass Mch. Co.	..	27½	29
American Window Glass Mch. Pfd.	..	..	50
American Window Glass, Pfd.	90	..	90
United States Glass	12½	13	12
Pittsburgh Plate Glass	..	..	280
Standard Plate Glass, Com.	..	..	4½
Standard Plate Glass:			
Pfd. Cumulative	..	..	18½
Prior Pfd.	..	..	30

TOLEDO, O., OCTOBER 22, 1928.

	Bid	Asked	Last
Owens Bottle, Pfd.	115½	..	115½
Libbey-Owens Sheet Glass, Com.	155	156	158
Libbey-Owens Sheet Glass, Pfd.	116¼	..	117

WHEELING STOCK EXCHANGE, OCTOBER 22, 1928.

	Bid	Asked	Last
Hazel-Atlas	92	93	92½
Imperial	..	40	72
Fostoria	..	..	..
Central	..	60	75
Jefferson, Pfd	..	..	96

READERS' WANTS AND OFFERS

GRADUATE CHEMICAL ENGINEER

Situation Wanted—Two years' experience in flint glass manufacture, both Laboratory and Plant Control experience. Reference will be furnished on request. Address SW-3, c/o The GLASS INDUSTRY, 50 Church Street, New York.

LAMINATED GLASS

Situation Wanted. Executive with years of practical manufacturing experience desires to make a change. Box SW-4, care of THE GLASS INDUSTRY, 50 Church Street, New York.

FOR SALE—Used Hardinge Mills

Selected from our Vast Stock for Immediate Shipment from various points in U. S.

2—2′x8″ Titanite lined
2—3′x8″ Unlined
2—3′x8″ Titanite lined
2—3′x3′ Batch Pebble Mills, silex lined
1—4′x12″ Porcelain lined
2—4½′x16″ Titanite lined
1—4½′x16″ Titanite lined with Hardinge Classifying System. NEW
1—4½′x16″ Silex lined
1—5′x22″ Titanite lined
1—5′x22″ Silex lined
1—6′x16″ Silex lined
2—6′x22″ Titanite lined
3—8′x22″ Titanite lined
1—8′x22″ Pebble Mill, liners removed
1—8′x30″ Titanite lined
1—8′x30″ Silex lined
1—8′x36″ Silex lined
3—8′x36″ Ball Mills, liners removed
1—8′x48″ Titanite lined
3—NEW Hardinge Rotary Air Classifiers, with lined exhausters, for 8′x36″ Mills.
2—NEW Gayco-Emerich 14-ft. Air Separators.
2—10-ft. Air Separators, Gayco and Sturtevant.
2—Raymond Air Separating Systems, 6-ft. and 7-ft. dia.

WE ALSO BUY *and* SELL

Rotary Kilns and Dryers.
Crushers: Jaw, Gyratory, Roll—all sizes.
Swing Hammer Mills.
Tube, Ball and Pebble Mills.
Pulverizers: Raymond, Fuller-Lehigh, Bradley, Sturtevant, Kent, Etc.
Storage Tanks, Filter Presses, Pumps, Etc.

Send us a list of your Surplus Equipment

Consolidated Products Co., Inc.,
19-21 Park Row, N. Y. City. Phone Barclay 0602
Shops and Yard at Newark, N. J., Cover Six Acres

Current Prices of Glass-Making Materials

October 22, 1928

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10–.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	.38	.38
Alcohol, denatured	gal.	..	.53
Aluminum hydrate ($Al(OH)_3$)	lb.	.04½–.05	.05½–.06
Aluminum oxide (Al_2O_3)	lb	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	.10½
Antimony oxide (Sb_2O_3)	lb.	..	.13
Antimony sulphide (Sb_2S_3)	lb.	..	.13
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.05
Barium carbonate ($BaCO_3$)			
Precipitated	ton	57.50	60.00
Natural, powdered, imported	ton	45.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	28.00-35.00	..
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	..	16.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.02½–.03	.02¾–.03¾
Boric acid (H_3BO_3)	lb.	.07–.07¼	.07¼–.07¾
Refined	lb	.07–.07¼	.07¼–.08
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	.90-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.27	.28
Cobalt oxide (Co_3O_4)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	.	.30
Cryolite (Na_3AlF_6) Natural Greenland Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb.	.	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.30
Feldspar—			
100 mesh	ton	13.00-20.00	15.50-22.00
80 mesh	ton	11.00-11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95–98% (max SiO_2, 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	.08	.08½
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.03-.03½
Black (FeO)	lb.	.03½	..
Kaolin (f.o.b. mine)	ton	9 00	..
English, lump, f.o.b. New York	ton	14.50–25.00	24.50–30.00
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	.	.
Lead oxide (Pb_3O_4) (red lead)	lb.	.09-.09¾	.09¾-.10
Litharge (PbO)	lb.	.077-.08¾	.08¾-.09
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	11.50-12.50	..
Burnt (CaO) ground, in bulk	ton	8.00	..
Burnt, ground, in paper sacks	ton	10.00-11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15–2.25	2.30–2.60
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.08
Manganese 85% (MnO_2)	lb.	.04	.04½
Nickel oxide (Ni_2O_3), black—			
for nickel content	lb.	..	.35
Nickel monoxide (NiO), green—			
for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	23.00–28.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08½	.09
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	06⅝	.07⅛
Hydrated 80-85%	lb.	.06	.06½
Potassium chromate (K_2CrO_4)	lb.	..	.28
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.09
Potassium nitrate (KNO_3) (gran.)	lb.	..	.05⅞–.06
Potassium permanganate ($KMnO_4$)	lb.	.15	.16
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.23
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	19.00-22.00	..
Selenium (Se)	lb.	..	1.90-2.00
Silver nitrate ($AgNO_3$)	(100 oz.) per oz.	..	.39½
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	..
In barrels	Per 100 lb.	1.55–1.57½	2.40
In bags	Per 100 lb.	1.37½-1.40	..
Spot orders .025 per 100 lbs. higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07¼
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.90	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04½
95 per cent	Per 100 lb.	2.15-2.20	2.50
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.38½	..
Tin oxide (SnO_2) in bbls.	lb.	..	.54
Uranium oxide (UO_2) (black, 96% U_3O_8)			
100 lb. lots	lb.	..	1.50-2.25
Zinc oxide (ZnO)	lb.	.06½-.08½	.12
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½–.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS Corrected to September 26, 1928	August 1927 Quantity	August 1927 Value	August 1928 Quantity	August 1928 Value	Eight Months Ending August 1927 Quantity	Eight Months Ending August 1927 Value	Eight Months Ending August 1928 Quantity	Eight Months Ending August 1928 Value
Glass and glass products (total)	.....	$692,738	.....	$766,985	.....	$5,871,648	.....	$6,556,280
Plate and window glass—								
Window glass, common, box 50 sq. ft.	2,111	9,909	466	3,801	15,856	84,615	10,626	65,899
Plate glass, unsilvered, sq. ft.	156,122	44,340	171,670	39,662	705,382	225,265	1,494,016	441,403
Other window and plate glass lbs.	238,466	38,824	413,268	37,819	2,935,717	301,323	2,215,488	245,363
Glass containers (bottles, vials and jars)	.....	257,047	.....	266,580	.....	2,046,289	.....	2,401,489
Table glassware, plain	.....	94.401	.....	101,497	.....	946,641	.....	875,391
Table and other glassware, cut or engraved	.....	16,021	.....	9,022	.....	93,751	.....	100,059
Lamp chimneys and lantern globes lbs.	109,016	23,037	132,391	26,363	1,328,302	271,896	1,211,463	240,989
Globes and shades for lighting fixtures lbs.	124,403	42,655	220,791	64,656	1,142,033	412,976	1,181,212	422,545
Chemical glassware lbs.	19,285	15,985	14,830	13,920	136,554	123,291	137,336	124,422
Electrical glassware, except for lighting lbs.	141,868	17,718	239,584	20,864	1,624.050	161,310	3,103,734	251,035
Other glassware	.....	132,801	.....	182,801	.....	1,204,291	.....	1,387,685

IMPORTS Corrected to September 26, 1928								
Glass and glass products	.....	$1,527,319	.....	$1,682,156	.....	$11,103,356	.....	$9,757,622
Cylinder, crown and sheet—								
Unpolished—								
Weighing less than 80 pounds per case dut. lb.	4,032,429	106,025	4,615,324	179,968	33,073,615	853,691	24,258,784	736,087
Weighing 80 pounds or over per case dut. lb.	2,831,914	102,961	1,848,376	108,517	27,851,932	1,186,147	21,556,110	984,590
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	35,856	.....	51,453	.....	256,476	.....	362,702
Plate glass—								
Polished, unsilvered dut. sq. ft.	1,446,257	366,164	1,343,754	287,102	11,316,126	3,241.245	10,277,237	2,232,408
Other dut. sq. ft.	123,644	26,256	211,830	60,816	791,523	187.809	1,158,892	302,458
Bottles, vials, jars, demijohns and carboys, molded or pressed dut	.....	16,601	.....	23,508	.....	128,037	.....	150,172
Table and kitchen utensils dut.	.....	21.826	.....	27.994	.....	88,401	.....	183,322
Glassware, cut or decorated dut.	.....	330,245	.....	307,654	.....	2,278,642	.....	1,740,586
Blown glassware, n. e. s.—								
Bottles, ornaments, gauge glasses and other n. e. s. dut.	.....	257,581	.....	327,907	.....	916,764	.....	1,072,323
Bulbs for electric lamps dut. No.	1,170,403	10,800	2,296,812	26,716	9,566,704	90,268	10,074,163	107,662
Chimneys, globes, shades, prisms and other illuminating glassware dut.	.....	92,870	.....	86,883	.....	590,727	.....	598,906
Articles and utensils for chemical, scientific, and experimental purposes dut.	.....	44,632	.....	52,876	.....	352,085	.....	369,057
Other glassware dut.	.....	115,502	.....	140,762	.....	933,064	.....	917,349